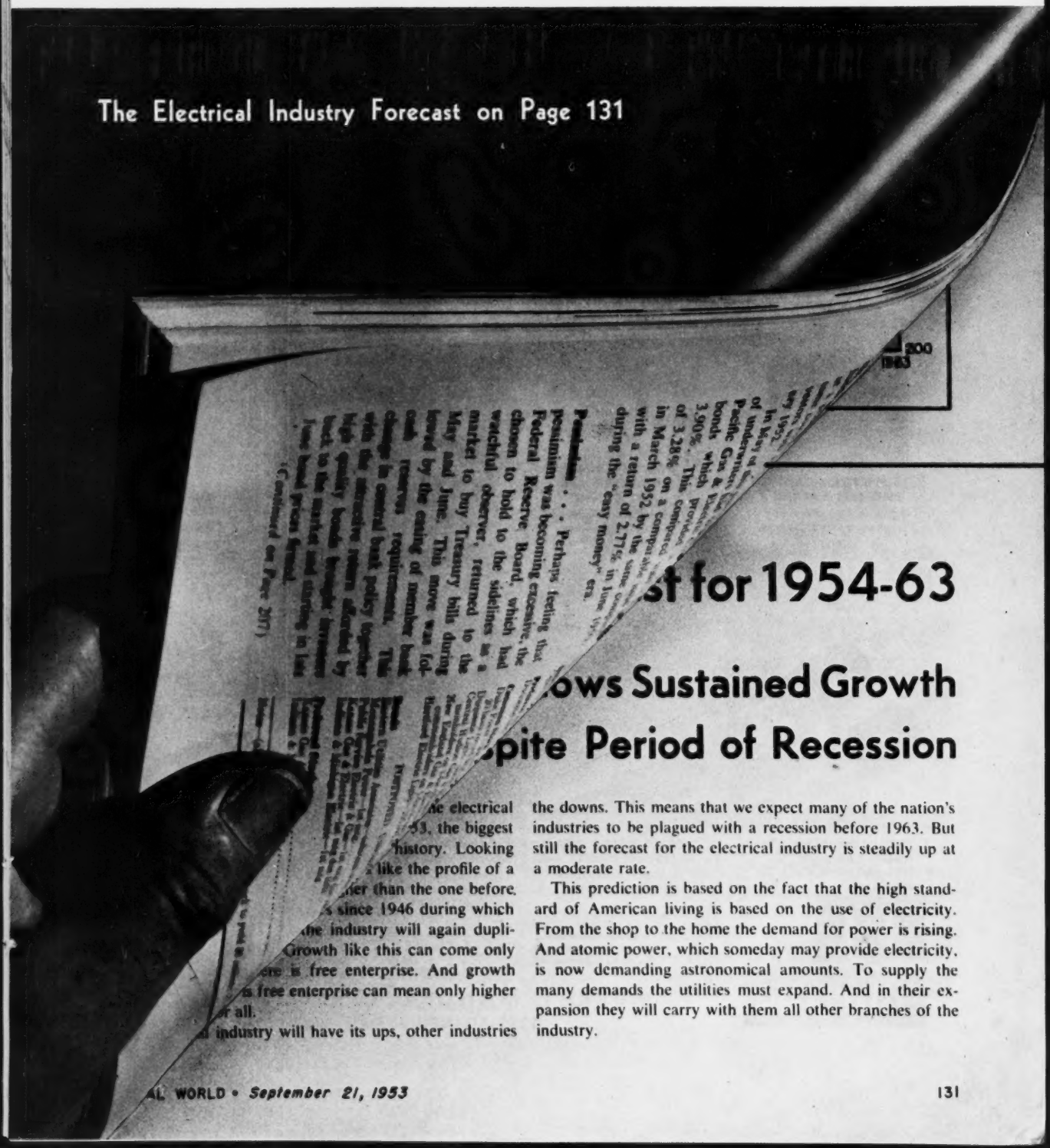
SEPTEMBER 21, 1953

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

The Electrical Industry Forecast on Page 131



...st for 1954-63

...ows Sustained Growth ...pite Period of Recession

...e electrical ...53, the biggest ...history. Looking ...like the profile of a ...ier than the one before. ...s since 1946 during which ...he industry will again dupli- ...Growth like this can come only ...ere is free enterprise. And growth ...s free enterprise can mean only higher ...or all.

...industry will have its ups, other industries the downs. This means that we expect many of the nation's industries to be plagued with a recession before 1963. But still the forecast for the electrical industry is steadily up at a moderate rate.

This prediction is based on the fact that the high standard of American living is based on the use of electricity. From the shop to the home the demand for power is rising. And atomic power, which someday may provide electricity, is now demanding astronomical amounts. To supply the many demands the utilities must expand. And in their expansion they will carry with them all other branches of the industry.

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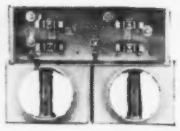
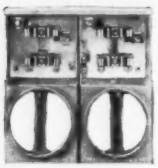
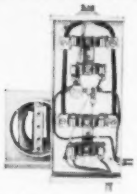


SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS



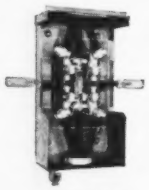
Raintight type — horizontal.



Raintight type — vertical.

SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.



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"A" BASE METER CONNECTION BOX
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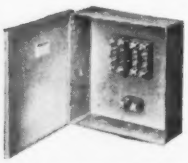

"A" BASE METER MOUNTING AND TEST CABINET
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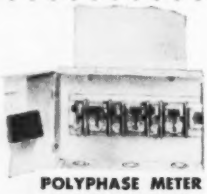

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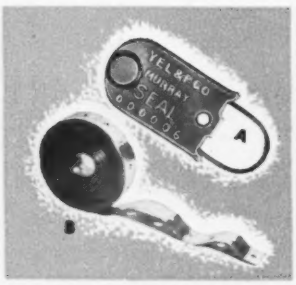

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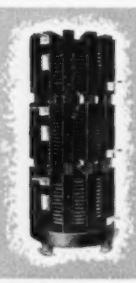

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Meet This Week's Writers

In this issue there is a forecast that in the next ten years the industry will spend billions of dollars to expand facilities. This means a steady parade of company executives to the financial markets. So that they will have some idea of future security markets, World has asked two financial specialists to discuss earnings in the next recession and outlook for common stocks.

Guercken Worked in England . . . C. P. Guercken, assistant to the financial vice president of Ebasco Services, foresees the earnings of electric companies remaining at a high level during the next recession. He has had considerable experience in economic and financial studies of the industry.

C. P. GUERCKEN

After getting his EE degree from New York University, he studied at the London School of Economics. He then acquired general operating and administrative experience with two of the largest private utilities in England. He later engaged in economic studies for the consulting firm of Merz & McLellan. Upon his return in 1940 he joined Ebasco.

Locke from Midwest . . . The long-term outlook for utility common is good, reports Ted Locke, public utility research specialist of Goodbody & Co. Ted, a Chicagoan, went to Northwestern and got his master's degree for writing a thesis on state regulation of public utilities. He studied under Dr Herbert Dorau; Ed Morehouse, now a General Public Utilities Co vice president; and Dr Richard Ely. He has worked for Utility Securities Co and Moody's Investors Service.

TED LOCKE

For ten years he has given courses at the New York Institute of Finance.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y.** Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation. **Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.**

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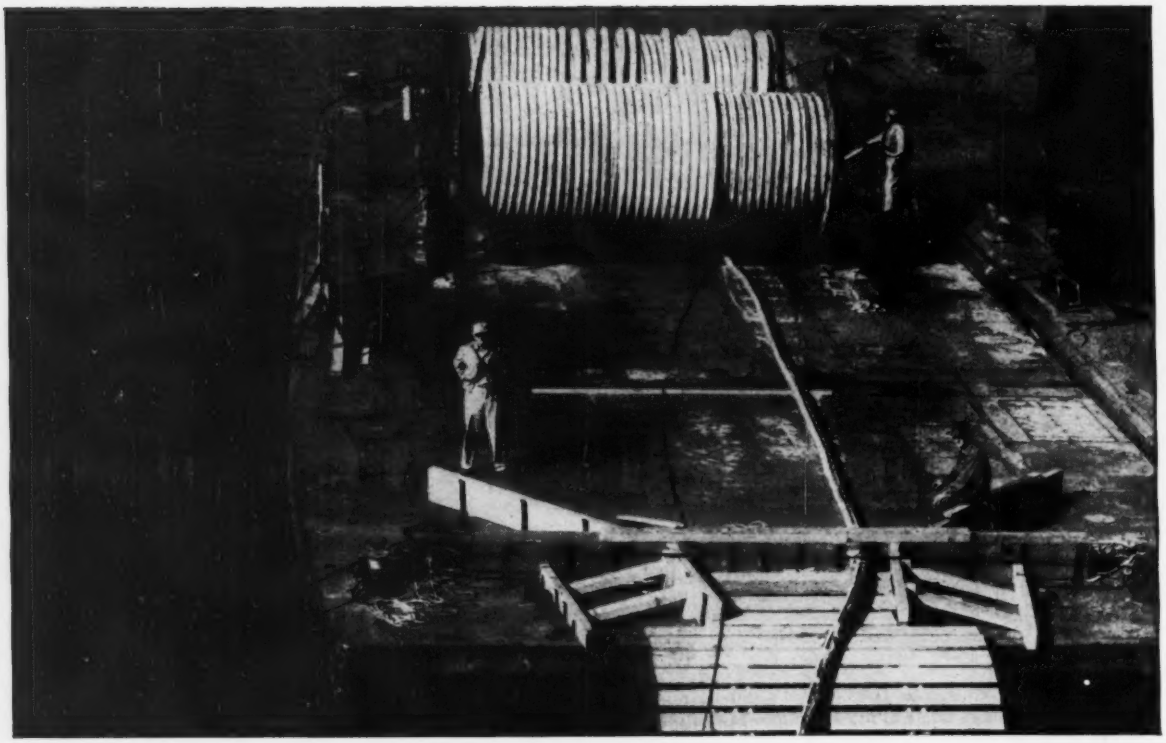

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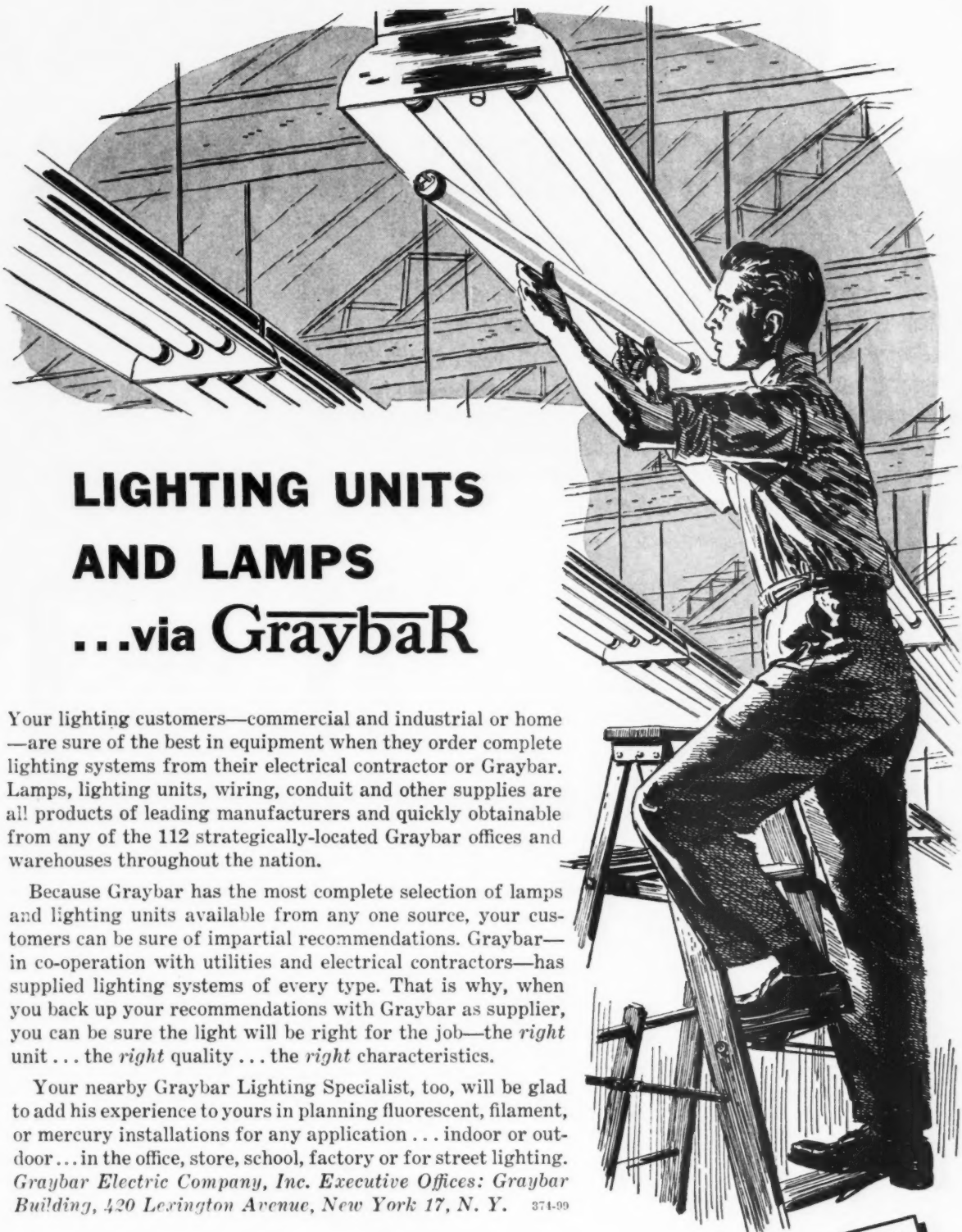

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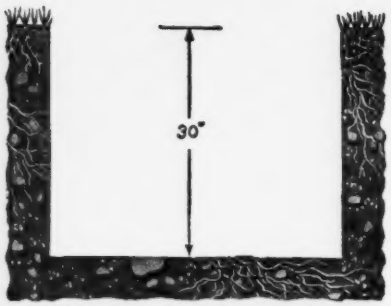
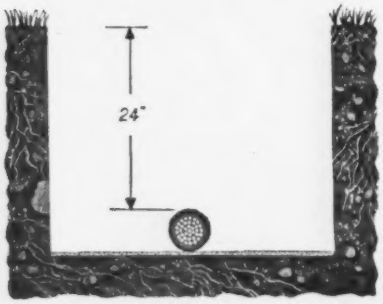
How to install buried cables in trenches

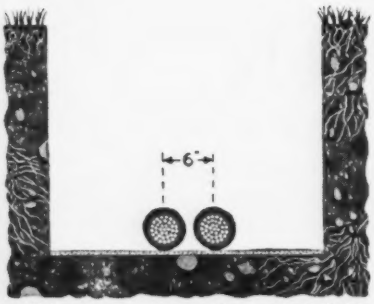
The most generally satisfactory way of installing buried cables is to lay them in a trench on a cushion of sand. There is less bending, distortion or tension than when a cable plow is used, a valuable factor if strains later occur through earth settling. The cable can also be protected by a treated plank or slab of concrete laid over it. Trenching permits the installation of cables at generally greater depths than does plowing. This greater depth makes cables less subject to damage by insects or rodents.



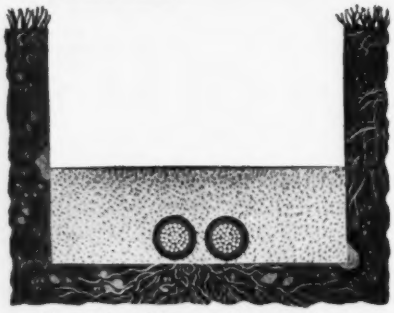
1. The trench should be deep enough (about 30") so that the cable, after providing the cushion mentioned below, will be at least 24" below the surface. This reduces the possibility of mechanical damage.



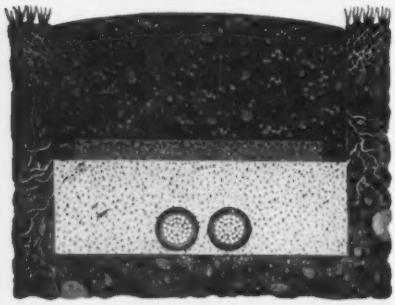
2. Put a cushion of sand on the bottom of the trench, or at least make sure the bottom is free of stones and other harmful debris. Lay cable with a slight snaking, to allow for earth settling and for expansion and contraction during load cycling.



3. When two or more cables are installed in the same trench, they should be spaced uniformly about 6" between centers so that the sand or earth can fill in around them. There must be no criss-crossing.



4. Cover the cable or cables to a depth of about 6" with sand or soft earth free from stones so that no rough edges will press against them.



5. Lay a concrete slab or creosote-treated plank on the sand or soft earth refill, to protect the cable and warn workmen of its presence. Complete the refill. Under highways, streets and rights-of-way, cables should always be installed in conduit.

Because of today's scarcity of rubber and copper, great care should be taken to see that your installations last as long as possible. With a few simple precautions, you can extend the life of your cables under normal operation. Although these precautions are well-known to many, we repeat them in the interest of getting maximum efficiency and long life out of our material and resources.

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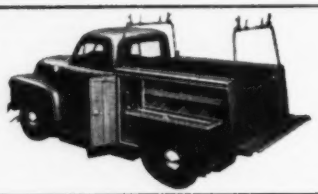

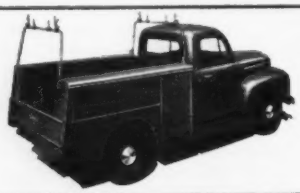

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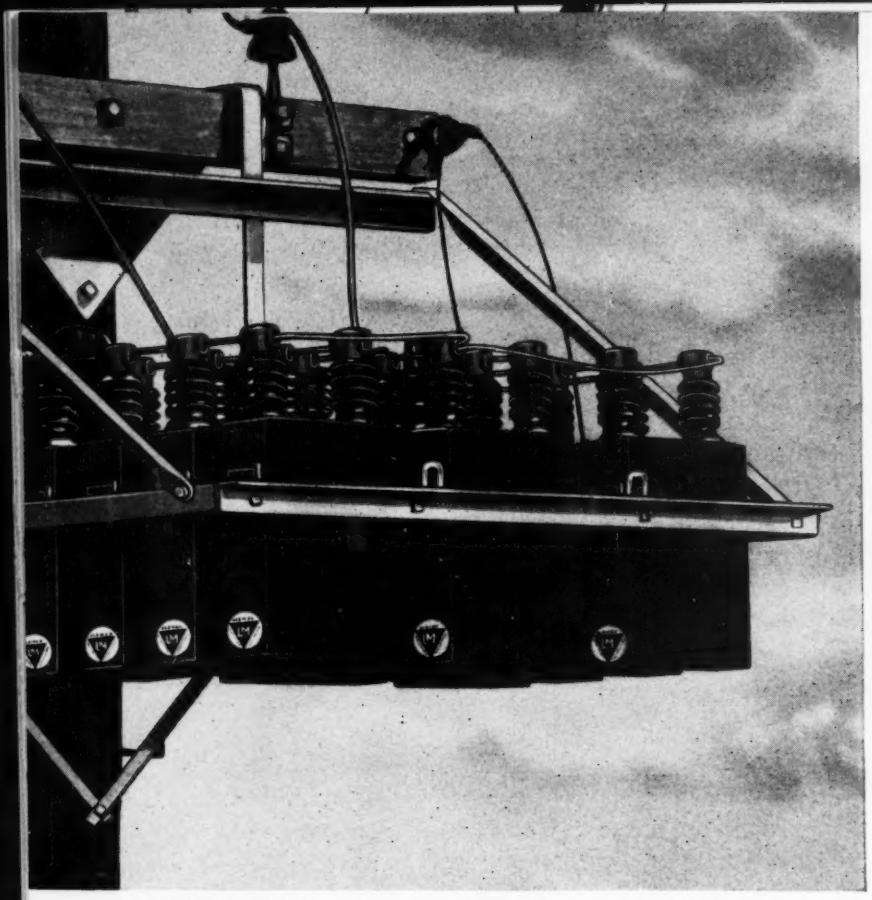

A 300 kvar switched capacitor rack installation. Wiring is completely neoprene-jacketed and bird-proof. Racks are available with or without the three L-M Kyle Type NR Oil Switches.

You Save 3 Ways With ELEMEX CAPACITORS

by **DANIEL J. J. PIRHOFER,** Sales Application Engineer, Capacitor Division, Line Material Company

Since utility systems install power factor correction equipment for its economic benefits, you might as well make the saving involved as great as possible. L-M's ELEMEX Capacitors offer 3 special savings:

1 You save on installation costs with completely assembled and factory-wired racks.

2 You save on over-all life cost because quality design and rigid quality control result in capacitors with an exceptional service record. Failure rate is less than one-half the national average.

3 You save on automatic switching with L-M's simple, rugged, economical Voltage Control.

Racks and their features are illustrated above. The exclusive process that gives ELEMEX Capacitors such long life is shown on the next two pages. On the fourth page is the L-M Voltage Control. May we give you details? Ask the L-M Field Engineer for a copy of Bulletin PC-1—and, if you like, a copy of "ABC's of Capacitors." Or, write me at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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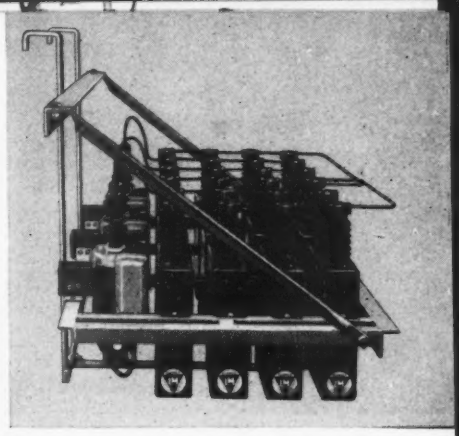
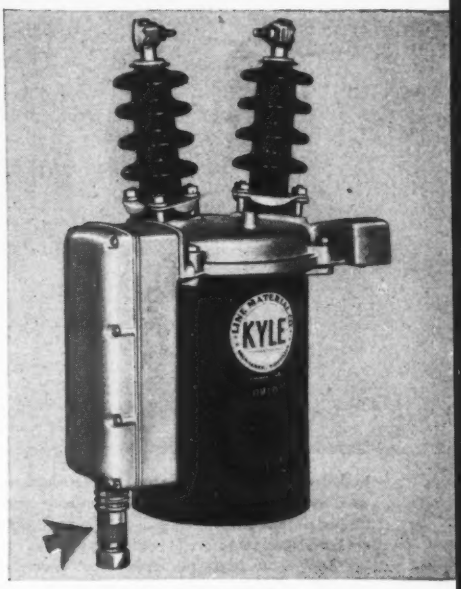
LINE MATERIAL

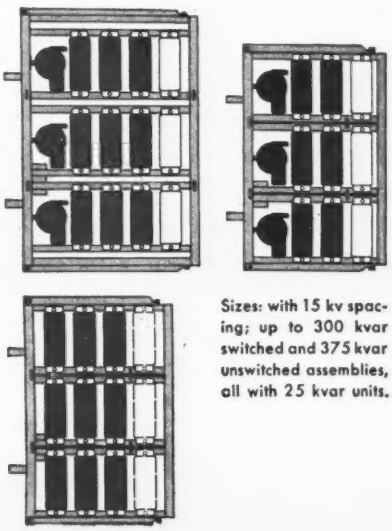
LM Elemex Capacitors



Stress on the pole is no problem—less than one transformer and one secondary drop. Capacitors are mounted vertically—which provides compactness and longer capacitor life.

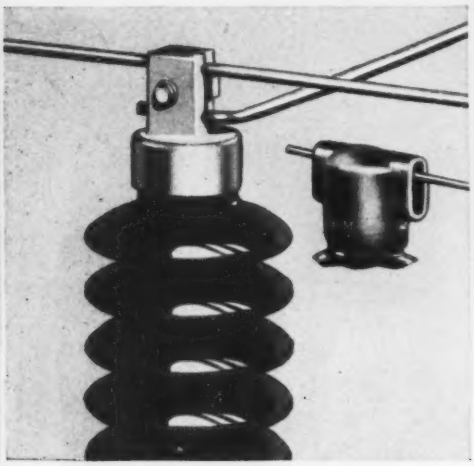


L-M Kyle Type NR Oil Switch. Only low-cost switch with 200 ampere thermal rating and full 150 ampere nominal capacitive rating at 15 kv. Weatherproof plug-in connection at the base of each oil switch control housing. This makes it easy to connect or disconnect the switch without disturbing any of the wiring. Only one easy-to-reach connection on each switch.

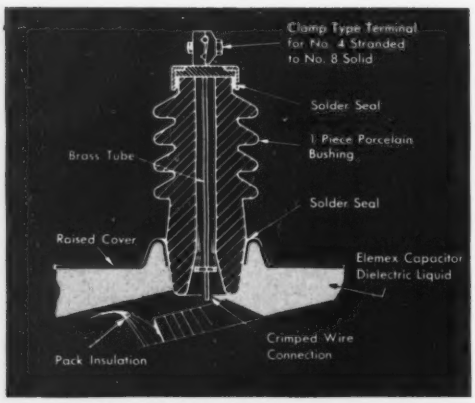


Sizes: with 15 kv spacing; up to 300 kvar switched and 375 kvar unswitched assemblies, all with 25 kvar units.

Every single pack is individually tested—with an over-voltage test that instantly reveals any actual and potential defects. Both faulty and marginal packs are rejected.



Exclusive "Paragroove" clamp-type terminal saves time and labor. Wire isn't threaded through a slot—it's just dropped in and clamped. Torque is vertical, not horizontal. Therefore in tightening you don't twist the bushing or stress the solder seal unduly. It's rugged; we've never had one break. No loose parts. Low resistance, less heating. Neoprene insulating caps also available.



Solder-sealed bushings are one-piece wet-process porcelain, with two metallized bands over the glaze. Bushings are hermetically sealed to drawn raised bosses in the cover that shed water like a duck. Strong? It takes over 3000 pounds to force an L-M bushing out of the cover. And they're 100% pressure-tested—every single one!

Packs are wound by automatic machines in spotless, dust-free, air-conditioned rooms. Once the machine is set, it automatically winds the proper footage of paper and foil and locates the position for the electrodes. Thus, uniformity is assured. Paper is the highest-grade dielectric tissue, of 8/10ths density, which adds greatly to the very low failure rate of ELEMEX Capacitors.

L-M's Exclusive Process

The exceptionally long life of ELEMEX Capacitors is proved in the laboratory with accelerated life tests, and in the field under actual service conditions. In the accelerated life tests, ELEMEX Capacitors last twice as long as other capacitors. This is true—but why it is true is because of a number of things.

The fact that we use 8/10ths density paper is *important*. This density seems to yield better to impregnation, without being too porous, and gives a lower paper power factor. This results in better performance.

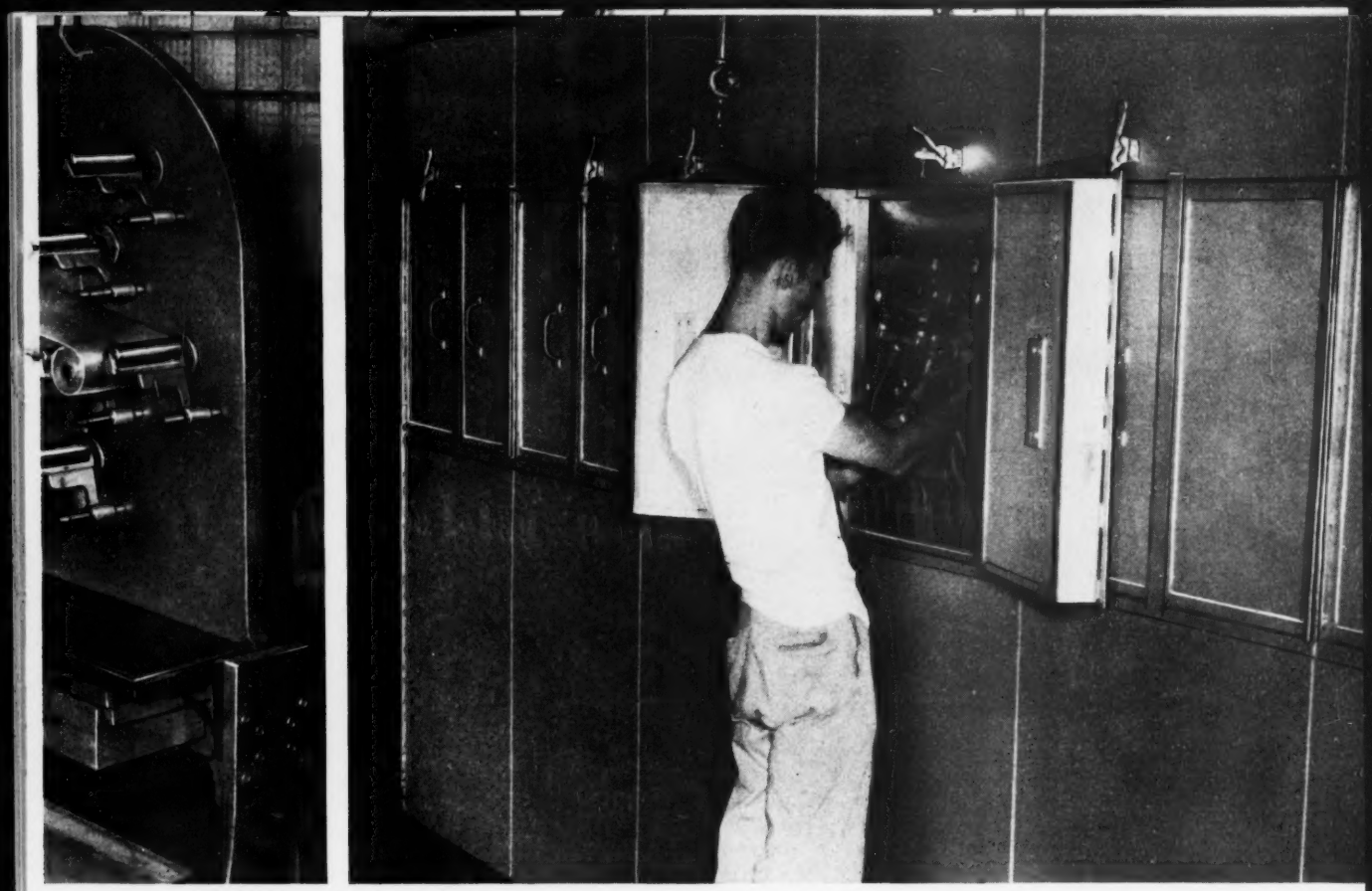
Another point is L-M's exclusive process of continuous, *individual* drying and impregnation. This is done with a very large-capacity high vacuum pump by means of individual capacitor connections, in an unsealed oven. Each unit is tested *during* the process.

Individual evacuation and testing assure that each capacitor becomes bone-dry, and that ELEMEX liquid slowly permeates every fibre of the paper. Even the bushings are completely filled with ELEMEX liquid, giving them exceptionally good electrical qualities.

The arc-welded tanks are designed to give the tank sides flexibility to allow for expansion and contraction of the ELEMEX liquid with changes in temperature. Tanks are sandblasted and then given three coats of baked enamel finish. The first coat is a red chromate primer, and the second and third coats are a melamine-modified alkyd resin enamel. This finish has been extensively tested under various weathering conditions. Severe atmospheric exposures such as coastal salt spray and sulphurous industrial conditions, and various laboratory tests, have proved the durability of the L-M finish as compared to other types of finishes.

ELEMEX Capacitors are outstanding in their performance and long life. L-M Field Engineers will be glad to supply additional data, details, and literature. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

"ELEMEX" is a Line Material trademark.



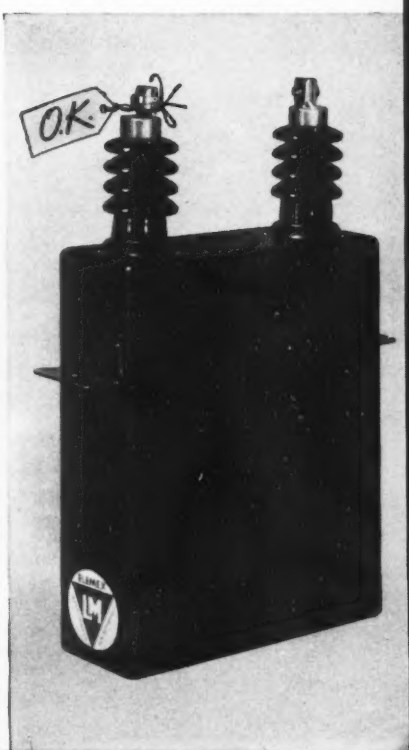
ELEMEX Capacitors are individually dried and impregnated in unsealed ovens like this. L-M evacuates only the *inside* of the capacitors, not the space around them. Air at controlled temperatures is circulated around the entire capacitor to maintain proper internal temperatures, giving better drying and complete impregnation. Also, the heat cures the paper, lowering its power factor and providing a low power factor in the completed unit. Each unit gets individual tests of power factor and capacitance *during* evacuation. These tests assure proper timing of each step in the process.

Reduces Capacitor Replacement

Tanks are sandblasted. Then they get a coat of red chromate primer, and *two additional* coats of melamine-modified alkyd resin enamel. Each coat is cured by baking.

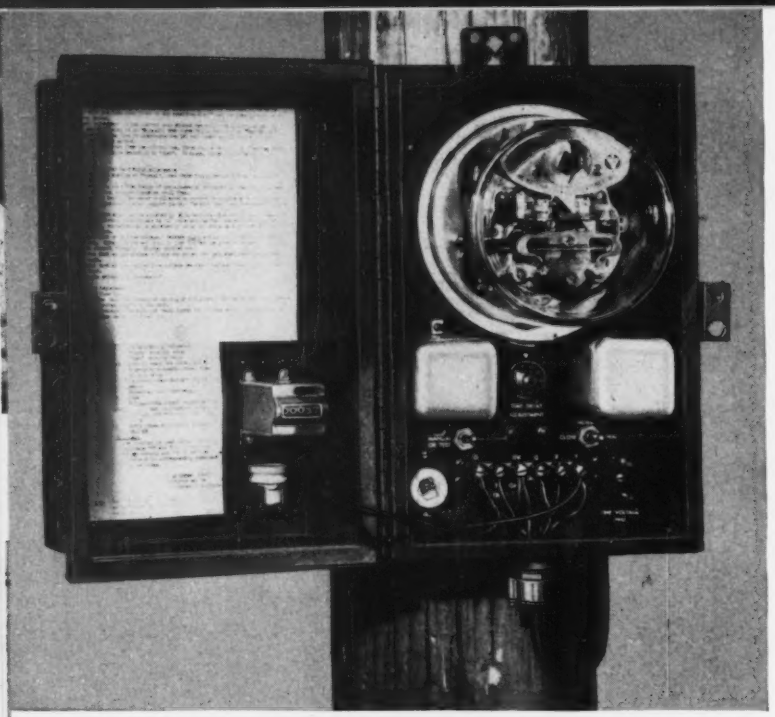
The completed capacitor. Its test record tag, which has followed it throughout the process, is filed. Stainless steel tank flanges carry the nameplate identification. All **ELEMEX** Capacitors have the same width and thickness. Hanger flanges are placed to provide uniform terminal elevation above the hanger in each voltage class. This makes it easy to change from 15 to 25 kvar, if desired.

148-2

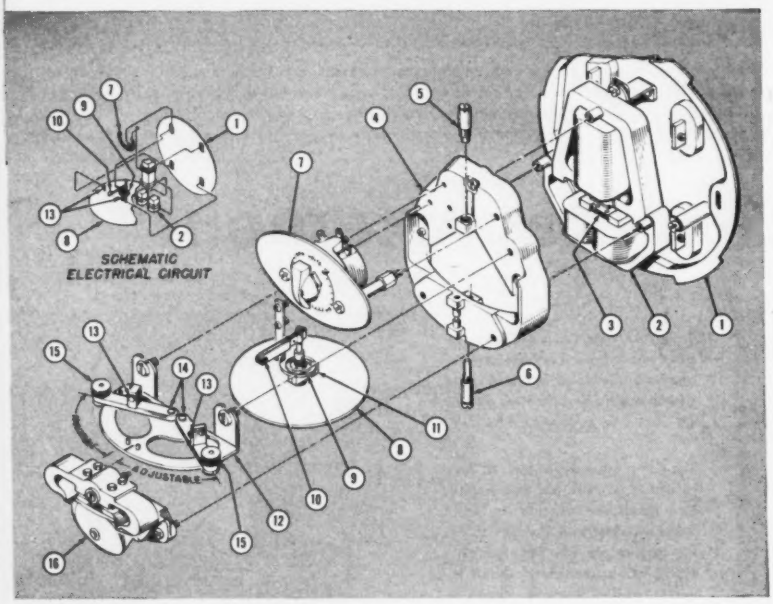


LINE MATERIAL

Elemex Capacitors



L-M's Voltage Control. Nominal line adjustment, 110 to 130 volts. Band width adjustment, 12 volts maximum. Time delay, instantaneous to 4½ minutes with synchronous motor drive. Toggle switches permit automatic, test or manual operation. Weatherproof steel cabinet with 1-inch threaded pipe fitting and two multiple knockouts.



Contact-Making Voltmeter Components

1. Base Plate
2. Core and Coil Assembly
3. Temperature-Compensating Magnetic Shunt
4. Frame Casting
5. Upper Bearing
6. Lower Bearing
7. Nominal Voltage Adjustment Rheostat
8. Induction Disc Assembly
9. Current-Carrying Spiral Spring
10. Moving Contacts
11. Static Counterbalance
12. Stationary Contact Plate Assembly
13. Stationary Contact
14. Bakelite Arms
15. Knurled Clamping Nut
16. Damping Magnet Assembly

Low-Cost Voltage Control for Capacitors

L-M's Voltage Control is a rugged, dependable device that makes automatic capacitor switching economical.

The L-M Type CCV Voltage Control provides a simple, economical method for switching capacitors. It was designed to eliminate some of the difficulties inherent in balanced-beam solenoid types of controls.

Its low cost makes it possible to take greater advantage of the benefits that switched capacitors can provide. While the unit is designed to operate with L-M's Kyle Type NR Oil Switch (incorporated in L-M's pre-assembled capacitor racks) the CCV may also be adapted for use with other motor-driven or solenoid-operated equipment such as circuit breakers.

Heart of the control is a modified watt-hour meter which has been made volt-sensitive. This unit provides easy adjustment, permanent bandwidth settings, convenient size, simple installation, and low cost. The device provides approximately 3/16-inch contact travel per volt (120 volt base), assuring extremely sensitive operation. The voltmeter is temperature-compensated from minus 30 to plus 140 degrees F. Line voltage can be determined without the use of portable instruments. Once band width and midpoint settings are established, they remain fixed.

Let Us Send You Details

Ask the L-M Field Engineer for copy of Bulletin PC-1, which includes detailed description of construction and operation features; or write Line Material Co., Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

"ELEMEX" is a Line Material trademark.

148-3

LINE MATERIAL

Elemex Capacitors

Wide Acceptance Shows Need For L-M Heavy Duty Cutouts

L-M's "PHD" (Porcelain Heavy Duty) Fuse Cutouts have met with wide acceptance all over the country. This shows the need that exists for a complete line of cutouts designed and built especially for service on high capacity distribution feeders.

5 kv

50 amperes
8000 amperes
interrupting capacity

100 amperes
14,000 amperes
interrupting capacity

200 amperes
20,000 amperes
interrupting capacity

L-M's "PHD" Cutouts, introduced more than two years ago, comprised the first complete line of heavy duty cutouts with realistic and usable interrupting capacities. Extensive testing was conducted for two years before they were introduced. Special attention was paid to design details, such as cementing, contact alignment, and door and cartridge positioning, which govern successful cutout operation. These cutouts successfully clear both high and low amperage faults—safely, without danger of exploding porcelain—and assure safety for personnel and equipment, and continuity of service.

"PHD" is a Line Material Company Trademark

7.5 kv

50 amperes
4000 amperes
interrupting capacity

100 amperes
8000 amperes
interrupting capacity

Here's Complete "PHD" Line

5 kv Rating	Interrupting Capacity rms amperes	
	2.5 kv*	5 kv**
50 amps.	8,000	5,000
100 amps.	14,000	10,000
200 amps.	20,000	15,000
7.5 kv	Interrupting Capacity	
50 amps.	4,000 amperes	
100 amps.	8,000 amperes	

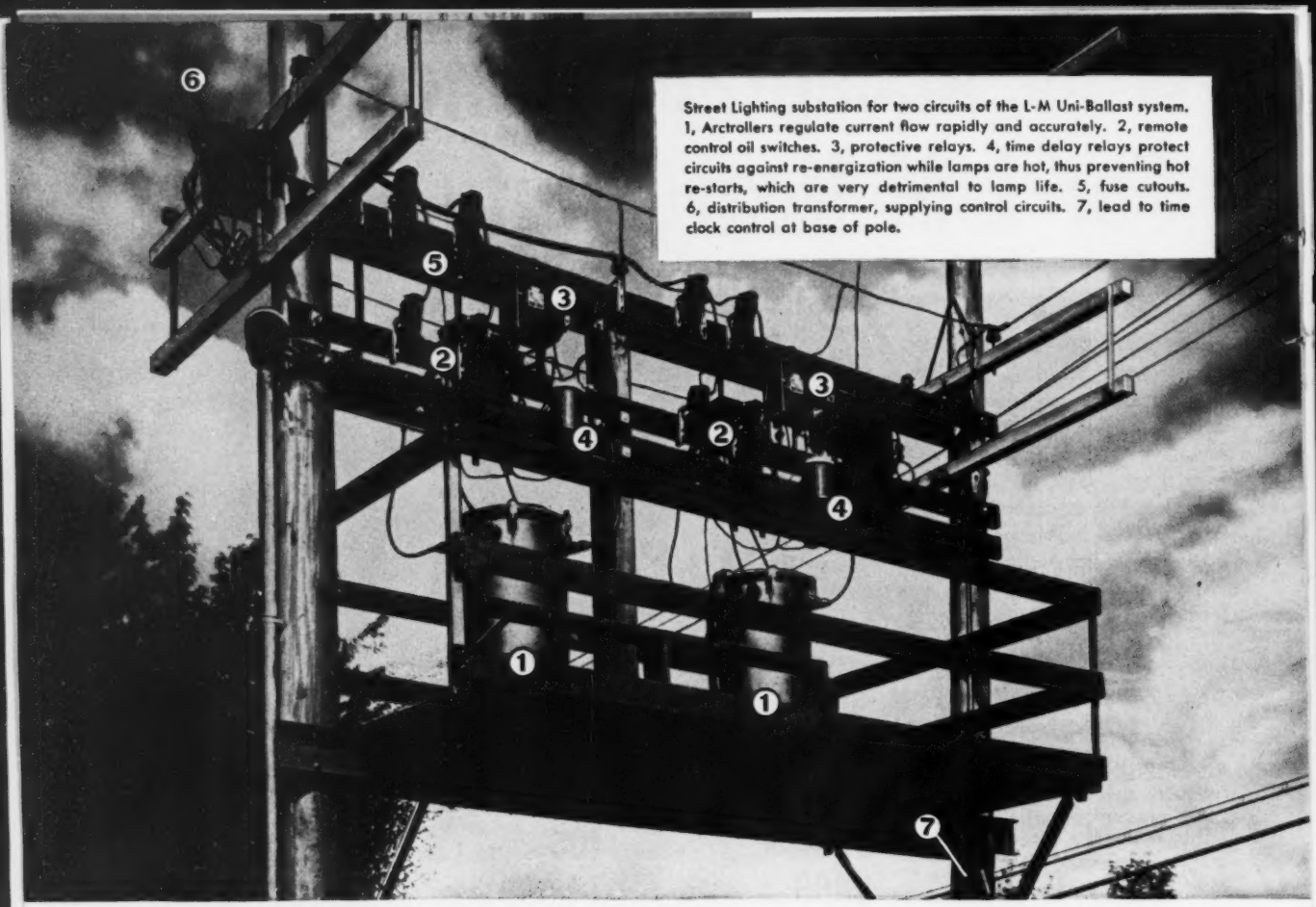
*or line-to-neutral on 4160 or 4330 volts Gr.Y. **or line-to-neutral on 8330 volts Gr.Y.

150

For information ask the L-M Field Engineer for Bulletins, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL LM

fuse cutouts and fuse links



Street Lighting substation for two circuits of the L-M Uni-Ballast system. 1, Arctrollers regulate current flow rapidly and accurately. 2, remote control oil switches. 3, protective relays. 4, time delay relays protect circuits against re-energization while lamps are hot, thus preventing hot re-starts, which are very detrimental to lamp life. 5, fuse cutouts. 6, distribution transformer, supplying control circuits. 7, lead to time clock control at base of pole.

L-M Uni-Ballast System Saves Up to $90 Per Pole in Mercury Vapor Street Lighting

Uni-Ballast is a new lighting system for operating series-connected mercury vapor lamps without individual ballasts. The system provides more uniform light output from each lamp, increased load factor, improved power factor, greater efficiency, and better lamp starting, resulting in substantial installation and operating economies.

Features of the L-M Uni-Ballast System

A new system for the operation of mercury vapor street lighting luminaires

1 **Eliminates Ballasts:** With the Uni-Ballast system up to 25 lamps are operated on one Arctroller, a static-type regulator. Individual ballasts are eliminated—resulting in important savings.

2 **Simplified Construction:** Elimination of ballast housings makes this substantial expense unnecessary, and gives a simpler, neater installation.

3 **Higher Electrical Efficiency:** The Uni-Ballast system saves 10 to 11 percent of the electrical energy required by an individual-ballast system. Power factor of the Uni-Ballast system is 95%, compared with 38% for a moving-coil regulator. Line loss is reduced 75%.

4 **Simplified Control:** The Uni-Ballast system carries up to 25 400-watt mercury vapor lamps with a single control station.

5 **Better Cold-Weather Starting,** longer lamp life: adequate voltage is available for starting lamps down to 40° below zero. Therefore, no half-load starters or other auxiliary starting devices are needed. Time delay relay prevents hot re-starts, which cut lamp life.

6 **Reduces Wiring Material:** Where new conductor is being installed, the amount of copper for circuit wiring can be reduced by more than 50%, as compared with multiple ballast systems.

7 **Gives Full-Load Operation:** The Arctroller will start strings of lamps up to its full rated capacity. A 10 kw Arctroller handles 25 400-watt lamps, which, on a conventional series-ballasted system, would require a 25 kw regulator.

Ask L-M Field Engineers for Complete Information

L-M's Uni-Ballast system offers many advantages. Ask the L-M Field Engineer for a complete discussion on its pros and cons, and about L-M's outstanding lighting engineering service. Or write Line Material Company, Street Lighting Division, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

"Uni-Ballast" is a Line Material Company trademark.

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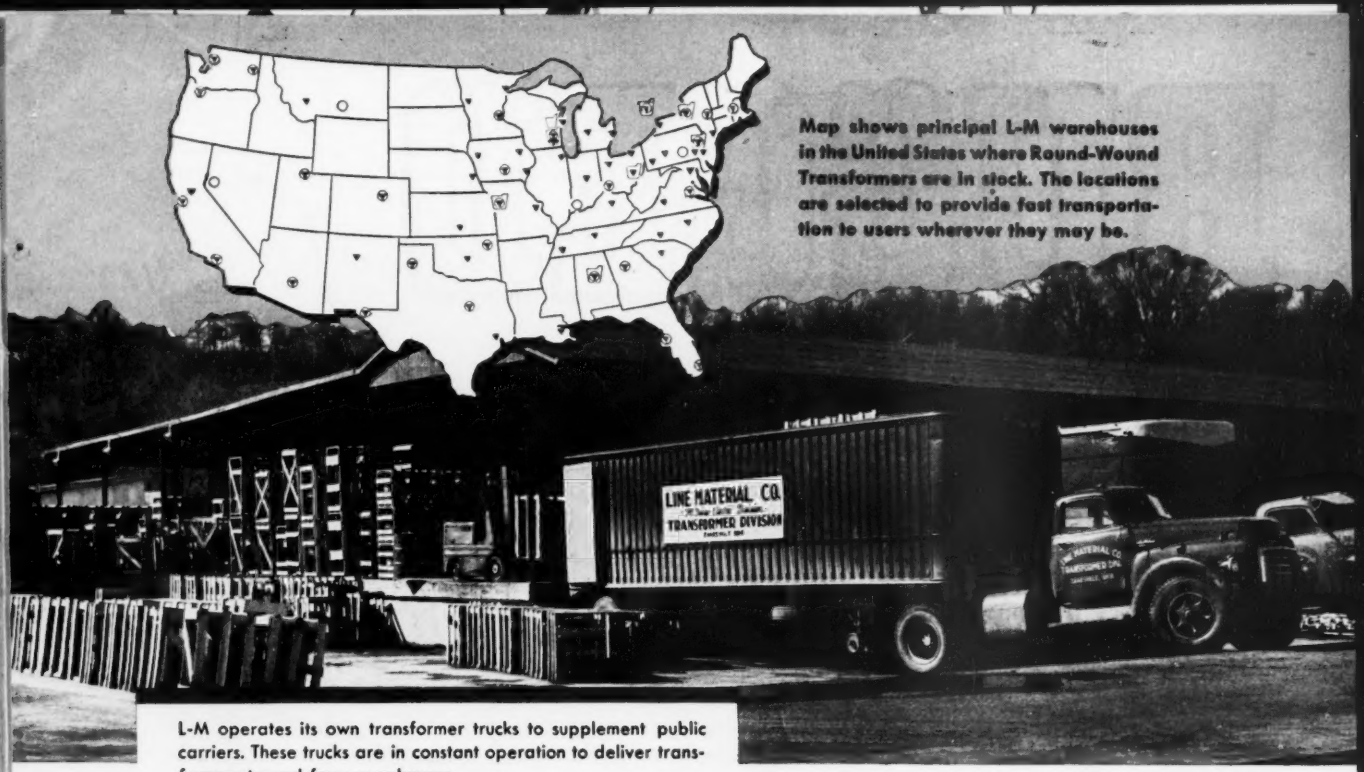
LINE MATERIAL
Street Lighting



Map shows principal L-M warehouses in the United States where Round-Wound Transformers are in stock. The locations are selected to provide fast transportation to users wherever they may be.

L-M operates its own transformer trucks to supplement public carriers. These trucks are in constant operation to deliver transformers to and from warehouses.

Stocks in 45 Warehouses Assure Prompt Delivery of L-M Round-Wound Transformers

When you need an L-M Round-Wound Transformer fast, L-M can get it there. To take care of customer requirements, L-M years ago set up a system of strategically located warehouses. In recent years production has been substantially increased for the express purpose of augmenting these warehouse stocks. Today most sizes and ratings of L-M Round-Wounds are available in a warehouse near you.

This warehousing service has been designed especially as a "customer plus" service. Operations have been set up to speed the handling of orders. L-M has set up its own transformer truck fleet to provide additional flexibility and faster service in emergencies.

Crating has been designed both for the protection of the transformer and for the convenience of the user. Bases of the crates are designed for lift trucks. High grade heavy lumber is used to assure the greatest possible protection to transformers and bushings.

If you want outstanding transformers, and prompt delivery, ask the L-M Field Engineer about L-M Round-Wound Transformers. Or write for Bulletin DT1, to Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

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Large stocks in all warehouses are designed so they will meet the needs of each particular area. In addition, a system of stock reporting makes it possible to transfer additional transformers promptly should a shortage develop at any one warehouse. Master stocks at the factory are crated, ready for prompt shipment.

"Round-Wound" is a Line Material Company trademark

LINE MATERIAL Transformers

RUGGED

AMP's New Line of Power Terminals Are . . .

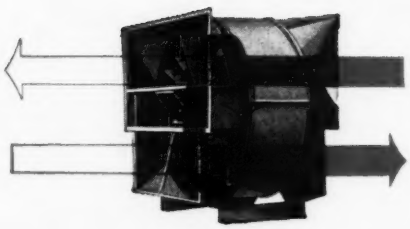
Built for Service!

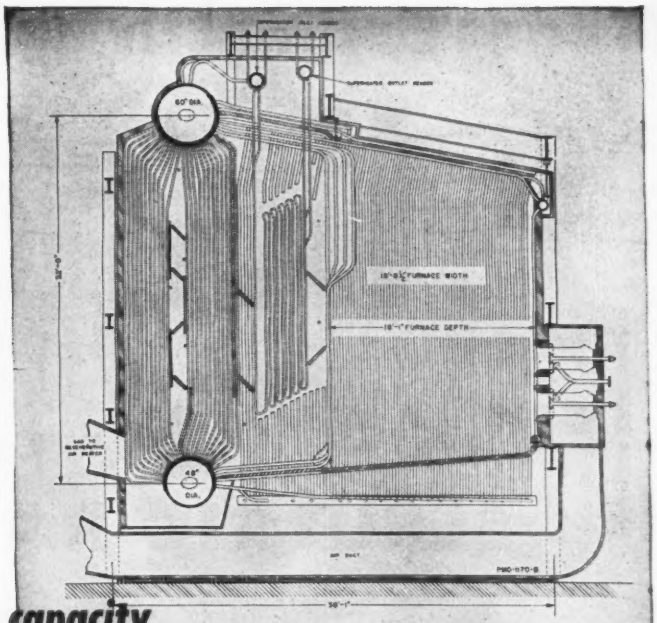
12 tons of pressure, yet only 12 pounds of weight makes AMP's new hand hydraulic tool your best bet for rugged, dependable installation of these AMP *precision-engineered* power terminals. Terminals and connectors are available in all ranges from #8 to #4/0. DESIGNED FOR USE ON ALL SHAPES OF WIRE: SOLID, STRANDED, SQUARE, OVAL, OR COMBINATIONS! Dies snap in and out easily. Tool automatically releases when crimping pressure is reached. Can be used with either pole strap or bench stand if desired. WRITE FOR SPECIAL POWER TERMINAL CATALOG.

AMP Trade-Mark
Reg. U. S. Pat. Off.

AMP

AIRCRAFT-MARINE PRODUCTS INC.
POWER TERMINAL DIVISION
2100 Paxton Street, Harrisburg, Pa.





3,375,000 pounds of steam capacity at Kaiser Aluminum & Chemical Corporation

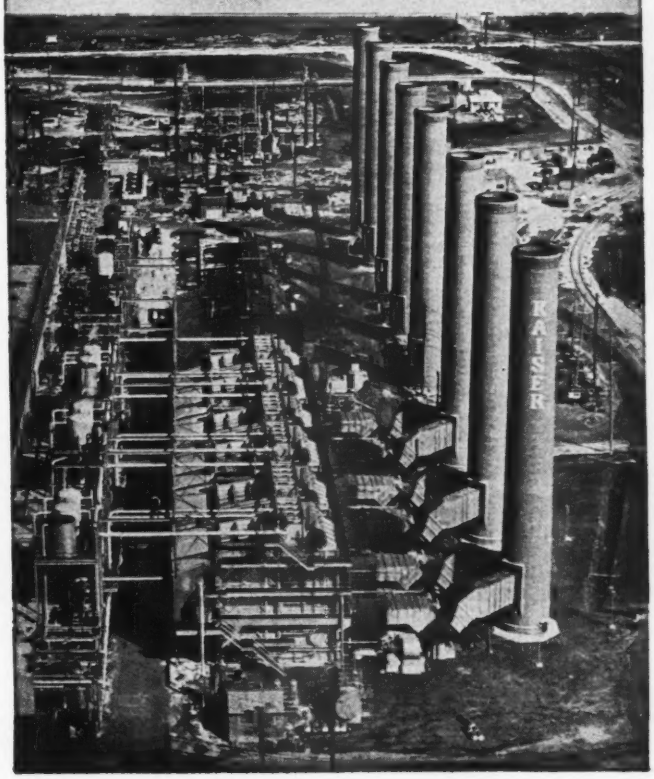
equipped with LJUNGSTROM AIR PREHEATERS

Four hundred million pounds of aluminum annually will be produced at the new Kaiser Aluminum & Chemical Corporation plant at Chalmette, La., when it is operating at full capacity. Designed and built by Kaiser Engineers, Division of Henry J. Kaiser Company, this plant will help meet the ever growing demand for aluminum products, both civilian and military.

Because it takes roughly 10 kwh of electricity to produce one pound of aluminum, the electrical generating capacity at this large new plant must be enormous. Therefore, when the plant is completed, it will have a total capacity of nearly 500,000 kw, of which 375,000 kw will be steam-generated.

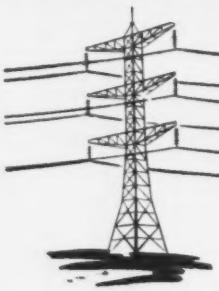
The plant's vast steam requirements are met by fifteen Foster Wheeler steam generators, each with a maximum continuous capacity of 225,000 lb of steam per hr at 900 psi and 905 F. Each boiler incorporates a Ljungstrom Air Preheater, which cools exit gas to 320 F, and preheats incoming combustion air to 540 F.

The Ljungstrom Air Preheater—chosen again and again where steam generation must be efficient—can serve you, too. Its wide acceptance by utilities . . . by consultants . . . by industrial plants all over the world is your assurance that the Ljungstrom is truly the most economical heating surface on the modern boiler.



THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

To Bring Electrical Living to More Families...



Hotpoint's

FULL-SIZED . . . 39-INCH ELECTRIC RANGE

AT ONLY $189.95 SUGGESTED RETAIL

This is the range you've told us you needed to bring electrical living to more families. Hotpoint has developed this marvelous low-priced range to do this specific job for you.

Offering features and performance you would expect to find in ranges selling at much higher prices, this Hotpoint RB49 is Hotpoint's answer to the market that demands a high quality electric range at a low price. Have your Hotpoint distributor give you the whole story . . . feature for feature . . . on this remarkable revenue-builder.

Here Is a Budget-Priced Range of Genuine Hotpoint Quality That Offers Features and Performance to Attract the Mass Market.

Again, Hotpoint looks at Tomorrow, Today!

HOTPOINT Co. *(A Division of General Electric Company)* ***5600 West Taylor Street, Chicago 44, Illinois***

Simplest Solution

FOR VOLTAGE PROBLEMS...

There is no simpler solution to a voltage problem than an Allis-Chalmers distribution regulator. You get accurate voltage over a narrow ±1 volt band in a unit built for years of satisfactory service. You get easy installation, simple operation, a mechanism with fewer parts than any other on the market, and a control that is simple to maintain. Most important, years of profitable operation in thousands of applications have proved the value of these simple units.

Plenty of Room for Future Expansion

Your system gets plenty of room to grow, thanks to the 20% range of A-C distribution regulators. And installation is so easy that interchange of units costs practically nothing when the time comes for matching greatly increased loads with larger capacity units.

Increase Profits . . . Cut Costs

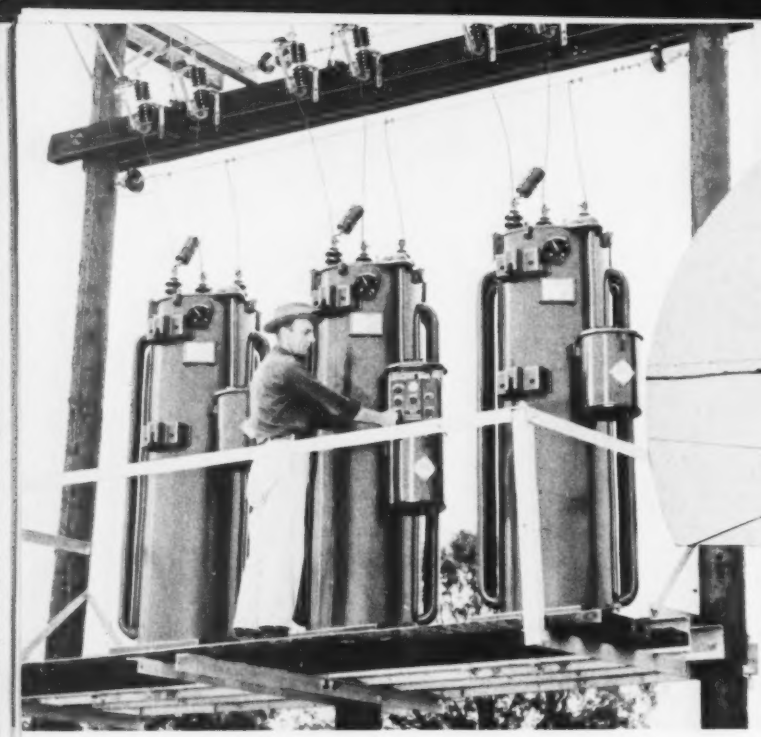
It's easy to see how system profits increase when distribution regulators are providing ±1 volt regulation. You don't lose revenue during peak loads—or waste power during light loads. In most cases, Allis-Chalmers distribution regulators pay for themselves in less than two years.

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Turn page

A-4153



Only Allis-Chalmers distribution regulators combine convenience of installation and operation with field-proved accuracy and reliability. It will pay to get more facts from your nearby A-C district office or by writing Allis-Chalmers, Milwaukee 1, Wis.

Fast Installation

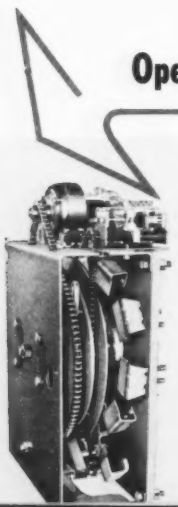
PLUS SIMPLE OPERATION...

Installing an Allis-Chalmers distribution regulator is easy. Put it on a pole near the load like a distribution transformer or mount it in a substation. Either way, pole or foundation, you save on installation expense. Many users put regulators on platforms suspended between two poles; others mount them two on one pole, the third on the next pole down the line for three-phase regulation near loads.

After your regulator is in place, placing it in operation is equally easy. Careful engineering has made it possible to begin operation after a single adjustment—setting the voltage level. Voltage band is pre-set at the factory for ±1 volt, but it can be changed to a different setting if desired.

Future inspection is especially easy. Thanks to unit construction—exclusive with Allis-Chalmers regulators — you can untank the regulator fast with little trouble. Core and coils are lifted out of the tank as a unit — and the control comes out with them. In fact, you can operate the regulator outside of its tank merely by connecting a separate voltage source to the control — then observing mechanical operation is easy.

Operating Mechanism Has Fewer Parts Than Any Other



THE HEART OF A STEP-TYPE REGULATOR is its tap-changing mechanism. In all Allis-Chalmers regulators you get the proved advantages of the *Quick-Break* mechanism. No other tap changer on the market can equal its simplicity, ruggedness, and reliability. Laboratory tests have proved that it can withstand five million operations—equivalent to 100 years of normal service. Field operation during the past twenty years on all types of regulators has proved its value in actual operation. The *Quick-Break* mechanism is one of the most important reasons why you can depend on Allis-Chalmers distribution regulators to add to system profits for years and years after increased profits have paid off the original investment.

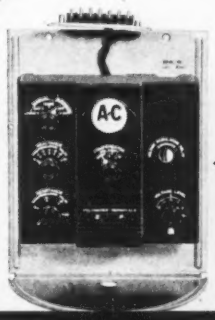
You Get These Important Features

- ★ ± 1 volt band.
- ★ 20% range of regulation.
- ★ *Quick-Break* Tap-Changing Mechanism—simplest on the market.
- ★ *Feather-Touch* controls for accuracy and easy maintenance.
- ★ Long-Life Contacts—good for two million operations.
- ★ Unit construction for easy routine maintenance.
- ★ Proof of performance, thanks to nine years of successful field operation.

RATINGS AVAILABLE	14,400 Volts — 50, 100 amp 7620 Volts — 15, 50, 100 amp 5000 Volts — 50, 100 amp 2500 Volts — 100, 200 amp

Control Is Example of SIMPLE MAINTENANCE

FEATHER-TOUCH controls—standard on all A-C 5/8% step regulators — offer extreme simplicity in maintenance as well as accuracy and reliability. If a control should need checking, it's a simple matter to remove and replace it because a single jack plug connects all wiring to the regulator. There are no connections to break, no wires to code. Just pull the single jack plug and replace the control with a spare — then the original control can be returned to the shop to be serviced. You save because linemen don't have to be highly trained technicians; experienced servicemen can spend their time working in the shop on other equipment, not wasting time driving to distant locations and climbing poles.

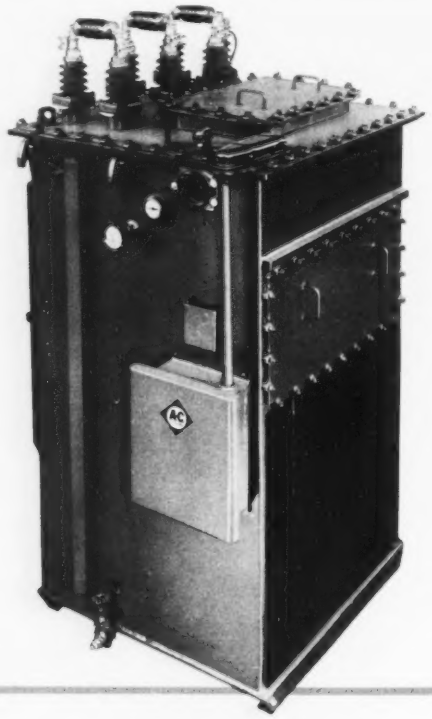


Complete Line

MAKES MAINTENANCE SIMPLE...

In addition to the low-cost distribution regulator, you can get either single- or three-phase station-type regulators from Allis-Chalmers complete line of 5/8% step voltage regulators. Since all the important features of A-C regulator design are common to all three units, you simplify your maintenance problems when your system is completely Allis-Chalmers equipped. Training servicemen is easier because there is only one principle of operation to be learned. And maintenance is simple because each regulator is equipped with the same basic advantages — like *Feather-Touch* control and the *Quick-Break* tap-changing mechanism. It pays to depend on Allis-Chalmers experience in design and manufacture of voltage regulators. Get more information from your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS

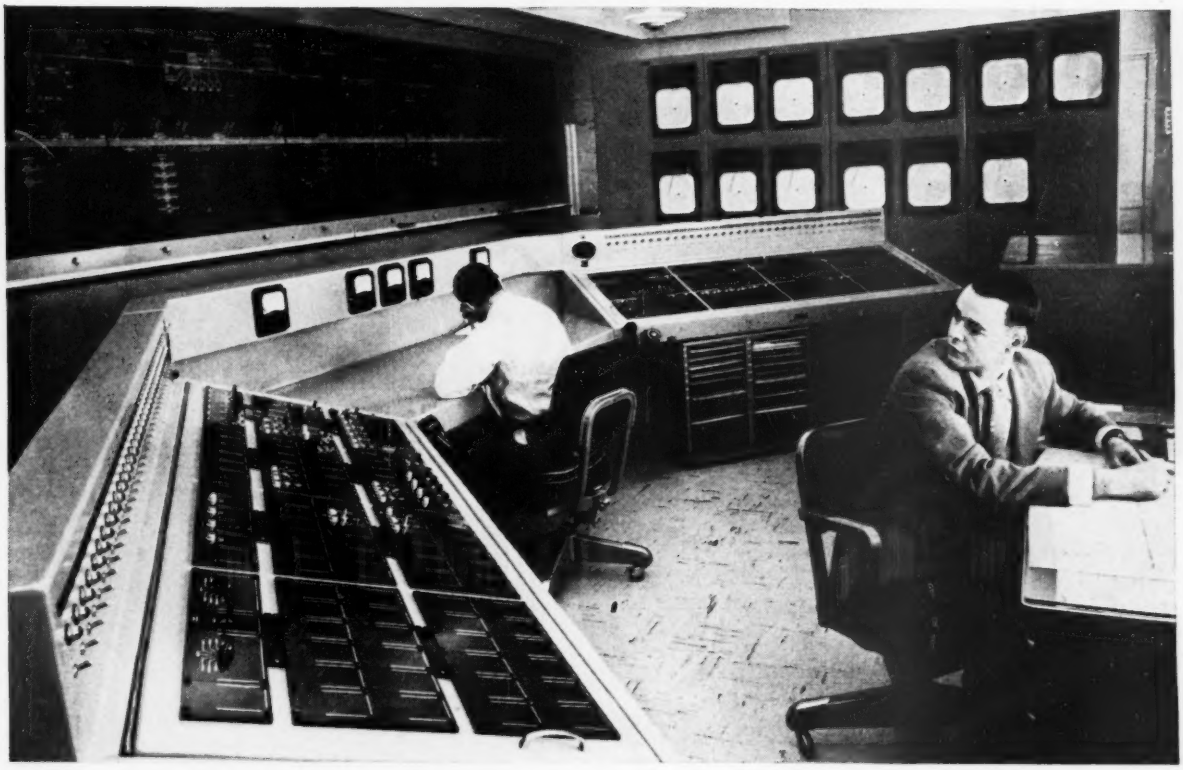


Station-type, single-phase regulator in sizes from 2400 to 6900 volts, 12 to 250 kva. Brings all the advantages of A-C 5/8% step regulation plus the *Vari-Amp* feature, which provides five current ratings instead of two as on other types of station-type regulators.

Station-type, three-phase regulator in sizes through 69 kv, 2500 kva. This is the original 5/8% step regulator for three-phase service.

ALLIS-CHALMERS

Originators of 5/8% Step Regulation



1000 MILES AT A GLANCE

You are looking at the Platte Pipeline Company's communications system. 1000 Miles of super-efficient microwave, surveyed, designed, manufactured and installed by *Philco* . . . world's leading manufacturer of microwave equipment.

The entire 1000 miles of this new microwave communications and control system can be seen in a glance at this terminal control board in Kansas City, Missouri. All functions of the pipeline can be observed and controlled at this point . . . The operation of pumps and compressors, the pressures and flow rates of oil, telegraphic printers, VHF mobile and stationery radio, even the operation of the microwave system itself.

Philco microwave provides complete communications and control for this giant pipeline with greater reliability and less maintenance cost than could be obtained from any other type of system.

For Complete Information Write to Department EW

PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

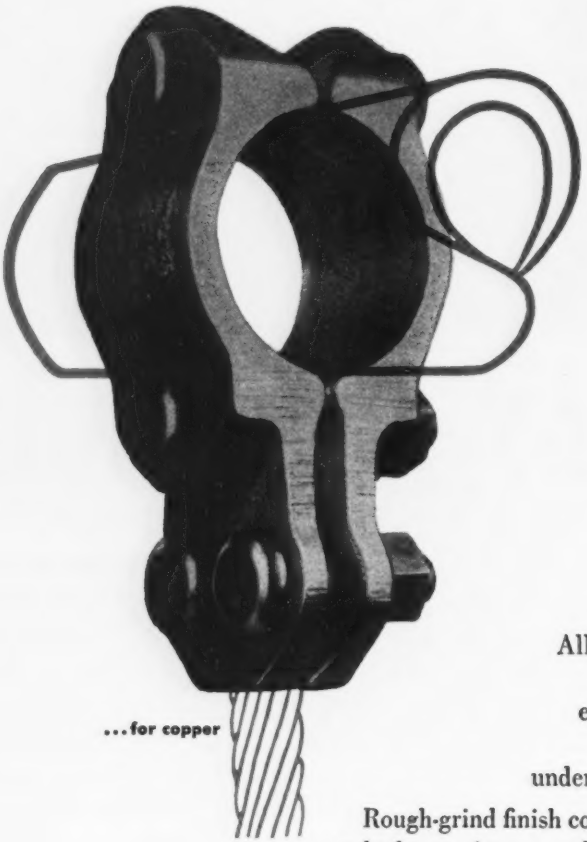
GOVERNMENT & INDUSTRIAL DIVISION

PHILADELPHIA 44, PA.

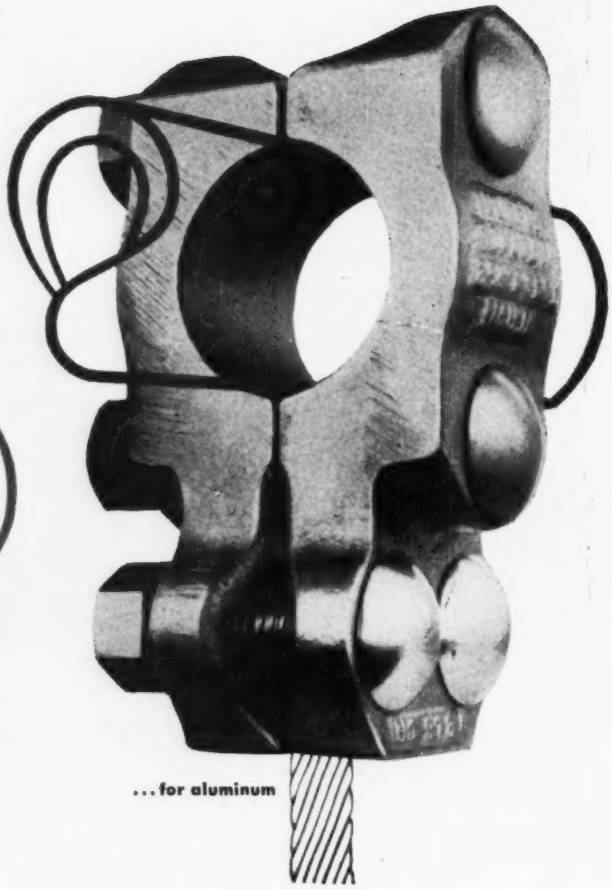
why are

BURNDY T-CONNECTORS

specified for TUBE-TO-CABLE?



...for copper



...for aluminum

All Burndy power connectors are constructed of selected corrosion-resistant alloys, and engineered mechanically and electrically to assure stable, low-resistance connections under the most severe operating conditions.

Rough-grind finish contact surfaces provide numerous current-carrying paths for maximum conductivity—over 100%. Oval-shank bolts, superior in design and materials, permit one-wrench installations, prevent stress corrosion and season cracking. For detailed listings write for Burndy Power Connector Catalog.

BURNDY

NORWALK, CONNECT. FACTORIES: New York, California, Toronto EXPORT: Philips Export Corporation TORONTO, CANADA

53-4

As Dependable as the Line or Bus

Setting up circuits for line rearrangement or apparatus overhaul is facilitated by easy-operating Pacific Air Switches which embody the experience of 47 years of air-switch manufacture.

These switches incorporate special means for minimizing the effects of ice, sleet, and high winds . . . and electrically they approach the dependability of the bus.

PACIFIC ELECTRIC

Type TG

AIR SWITCHES

with

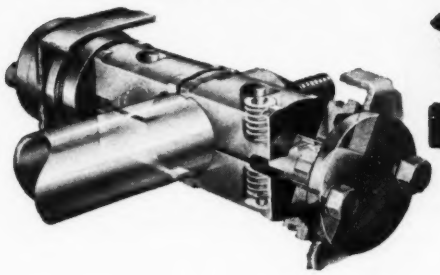
SOLID-SILVER INSERTS

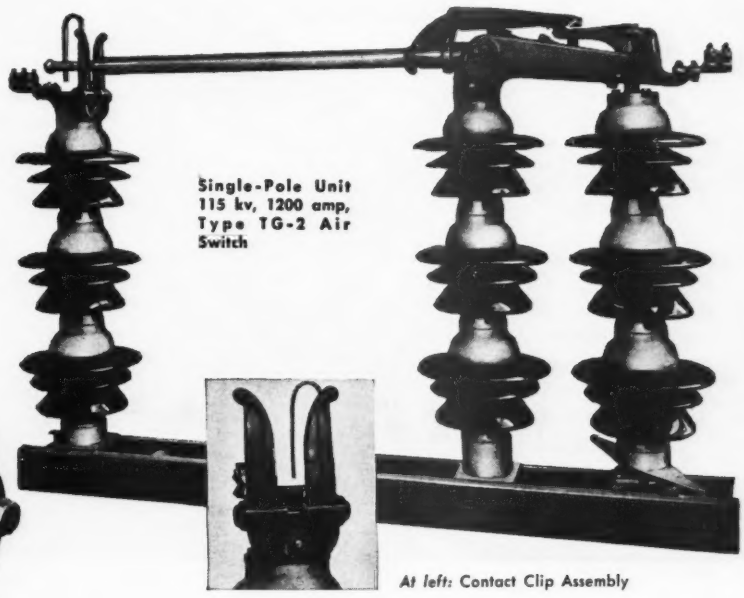
115, 161, 196, 230, and 287 kv (other types 7.5 kv and up)

ASA AND NEMA STANDARD

Above: Hinge Assembly — Switch Closed

Below: Phantom Interior of Continuously Applied Full-Floating Hinge-End Contacts (these are contained within a weatherproof housing, not shown)





Single-Pole Unit 115 kv, 1200 amp, Type TG-2 Air Switch

At left: Contact Clip Assembly

ELECTRICAL CONNECTION at the hinge of the Pacific Type TG Air Switch is through massive continuously applied full-floating duplex contact shoes having solid-silver inserts at all shoe contact points.

The configuration of the current path through the hinge is such that the contact pressure increases because of the electromagnetic forces of large momentary or fault currents.

The contact forks at the opening end of the switch do not bend as springs; each half-fork acts independently under adjustable pressure of a preloaded helical spring. This assures substantially constant pressure regardless of contact wear or off-center entry of blade. Both blade and forks have solid-silver inserts.

Generous use of enclosed anti-friction bearings, hardened and ground non-corrodible pins, and precision machining characterize the mechanical design.

A complete switch comprises three single-pole units together with operating mechanism. A grounding switch may be included, if desired.

PACIFIC ELECTRIC • MFG. CORPORATION •

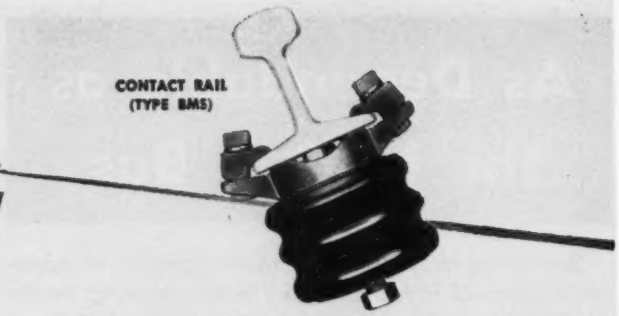
SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA
OTHER FACTORIES: SANTA CLARA, CALIFORNIA; GARY, INDIANA

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

KEYSTONE INSULATORS for INDUSTRY



CONTACT RAIL (TYPE BMS)

"SERVICE-ENGINEERED"

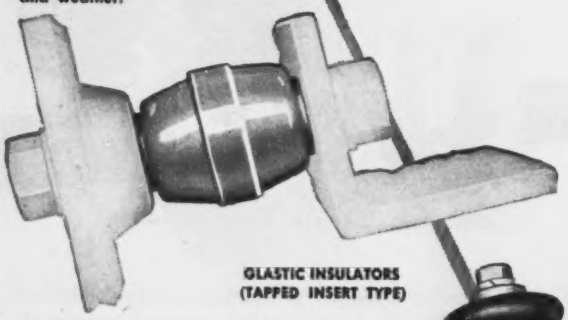
FOR UNFAILING PROTECTION ON THE TOUGHEST JOBS!

For longer, stronger life and peak protection, there's a Keystone Industrial Insulator that's "service-engineered" to meet every need. Let ESM engineers help you select the right mechanical and electrical qualities to solve your insulator problems. Call on them soon.

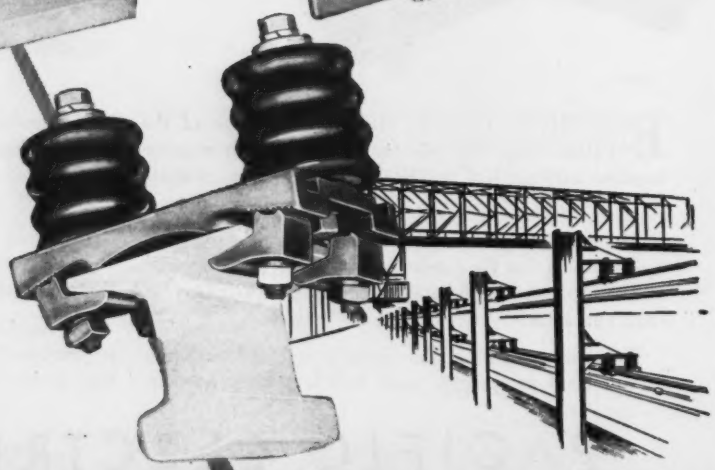
MOULDED GLASTIC INSULATORS

Fibreglass reinforcement and superior compounds provide maximum impact strength with excellent resistance to arc track, chemicals, heat and weather.

SUSPENSION INSULATORS

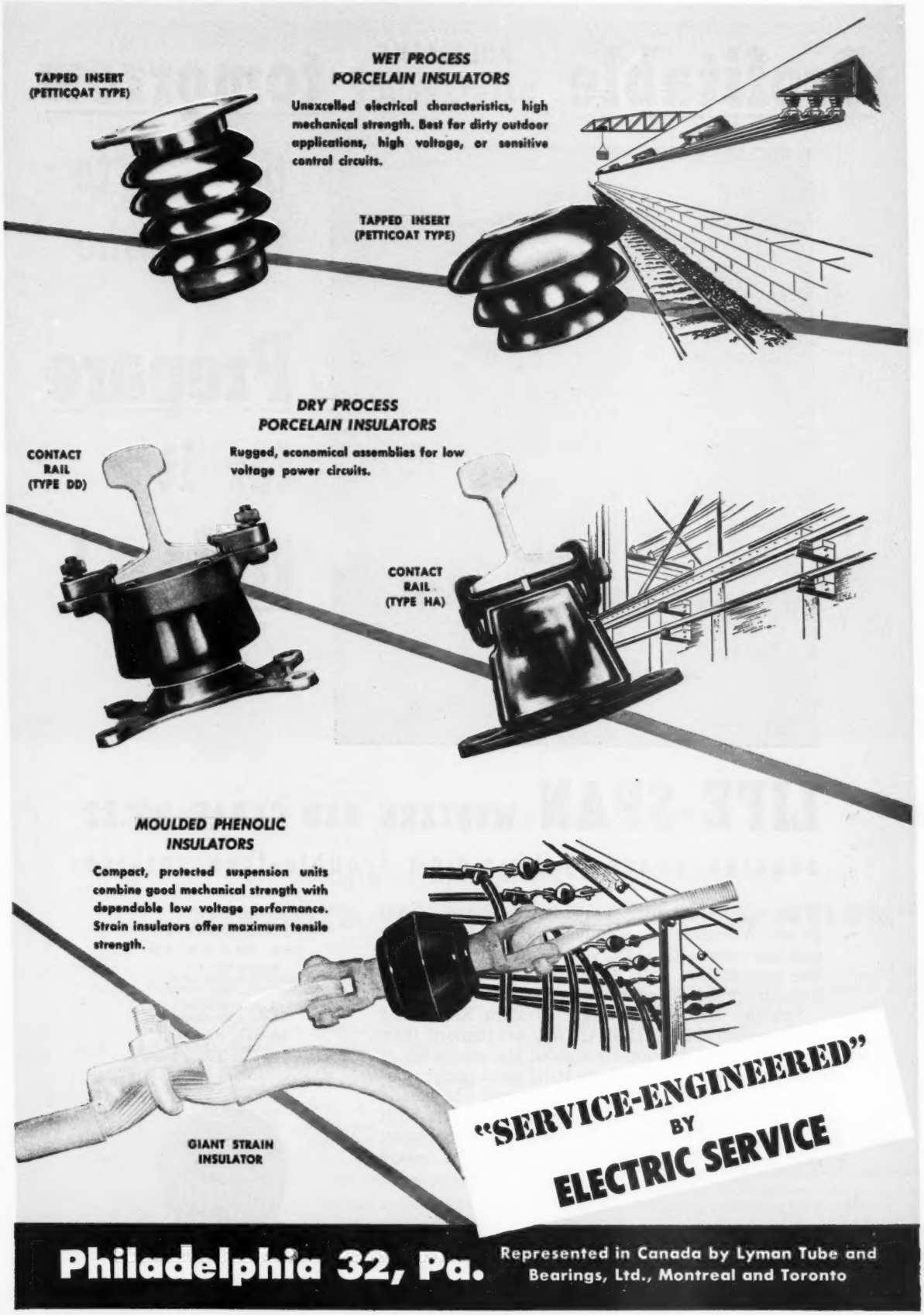


GLASTIC INSULATORS (TAPPED INSERT TYPE)

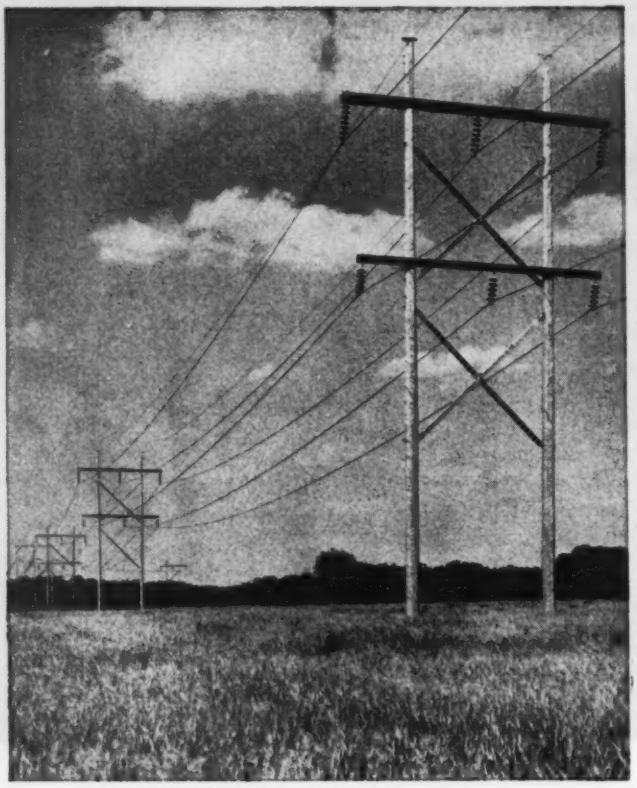


Basic units shown have great variety of application by use of proper fittings, selected from our Industrial Catalog. Write for illustrated folder.

ELECTRIC SERVICE MANUFACTURING CO.


TAPPED INSERT
(PETTICOAT TYPE)
WET PROCESS
PORCELAIN INSULATORS
Unexcelled electrical characteristics, high mechanical strength. Best for dirty outdoor applications, high voltage, or sensitive control circuits.
TAPPED INSERT
(PETTICOAT TYPE)
DRY PROCESS
PORCELAIN INSULATORS
CONTACT
RAIL
(TYPE DD)
Rugged, economical assemblies for low voltage power circuits.
CONTACT
RAIL
(TYPE HA)
MOULDED PHENOLIC
INSULATORS
Compact, protected suspension units combine good mechanical strength with dependable low voltage performance. Strain insulators offer maximum tensile strength.
GIANT STRAIN
INSULATOR
"SERVICE-ENGINEERED"
BY
ELECTRIC SERVICE
Philadelphia 32, Pa.
Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

Profitable POLE-LINE MAINTENANCE tomorrow



belongs to those who

Prepare for it today!

LIFE-SPAN WESTERN RED CEDAR POLES

assures years of l-o-n-g-e-r trouble-free service

Whenever maintenance costs go down company profits go up! Whenever you specify LIFE-SPAN Poles for pole-line construction jobs, you are insuring lower pole-line maintenance costs tomorrow—assuring greater company profits for many years to come.

Straight, strong, lightweight Western Red Cedar poles treated the LIFE-SPAN way are immune from decay or insect invasion throughout the service life of the pole. Their clean surfaces build good public relations for utility companies, while linemen who handle and work on them like them because they are both clean and safe to handle. To insure more company profits tomorrow, specify LIFE-SPAN poles today!

SOLD ONLY BY THE FOLLOWING:

Page & Hill, Inc.
Minneapolis, Minnesota
50 Church St., New York, N. Y.

B. J. Carney & Co.
Spokane—Minneapolis

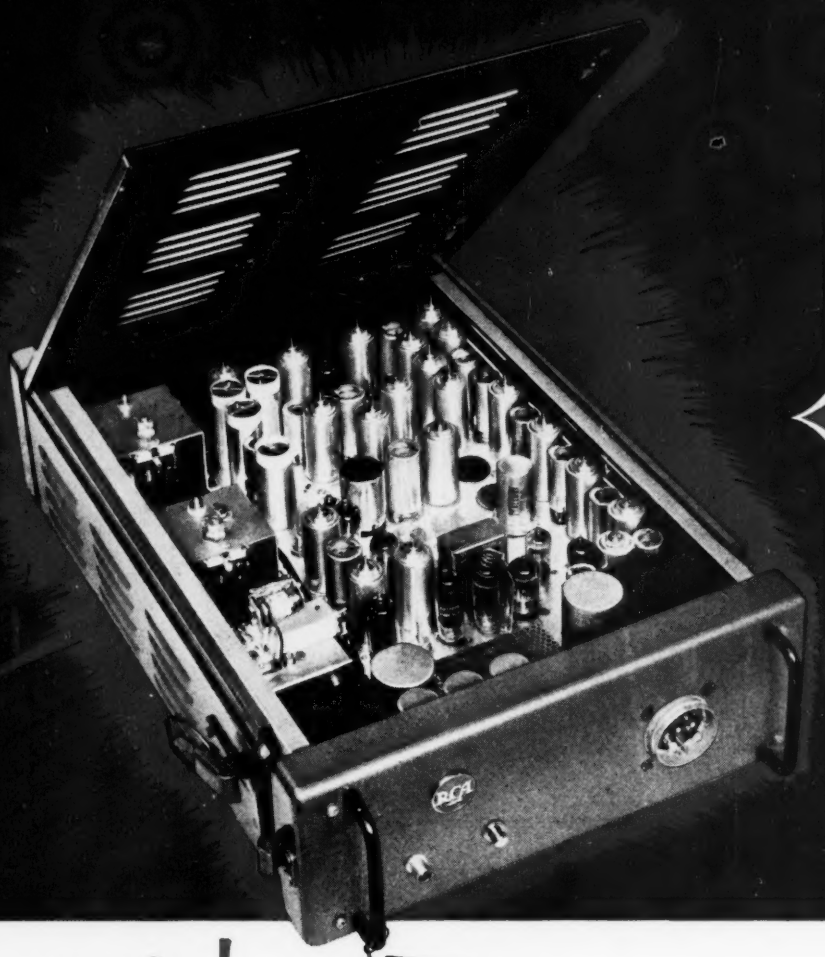
Schaefer-Hitchcock Co.
Sandpoint, Idaho
(Suppliers for Joslyn Mfg. & Supply Co.)

Naugle Pole & Tie Corp.
Chicago, Illinois

Life Span

CONSOLIDATED TREATING CO. MINNEAPOLIS, MINNESOTA

Get these 7 ALL-NEW FEATURES with RCA UHF 2-Way Radio



1. Low-cost tubes.
2. Improved coverage in city areas. Less noise, less absorption of signal.
3. High-efficiency power supply.
4. Optional operation on as many as four frequencies.
5. Built-in metering sockets to speed service.
6. 6-inch antenna to simplify installation.
7. "Split" drawer design for easy maintenance.

NEW RCA UHF 2-WAY RADIO

opens up traffic-free channels

PERMITS "UNCROWDED OPERATION"

IF YOU'VE been putting off 2-way radio . . . if you're now operating on an overloaded frequency . . . here's RCA 2-way radio equipment which utilizes many new uncongested channels in the Ultra High Frequency Band, 450-470 megacycles.

NOISE-FREE RECEPTION

With RCA 2-way radio, you eliminate most man-made and natural electrical noise, cut out ignition interference and assure top performance in severe noise areas.

PROVED IN ACTUAL FIELD USE

The UHF equipment, engineered to highest RCA standards, has proved its merit in actual field use in five important systems. The new RCA UHF equipment is ready now to help you solve your problem of channel overloading.

FOR NEW FREEDOM in radio operations check RCA Ultra High Frequency 2-way radio. MAIL COUPON NOW.

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Radio Corporation of America
Communications Equipment Dept. 45UD
Building 15-1, Camden, N. J.
In Canada: RCA Victor Company Limited, Montreal

Please send me information of RCA Ultra High Frequency (450-470 mc) 2-way radio.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

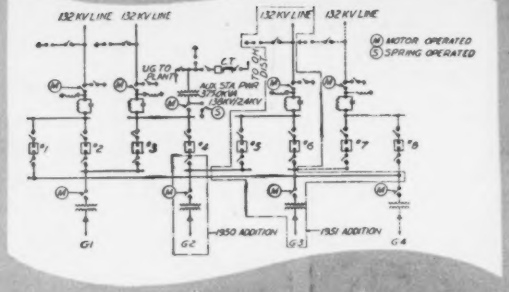
CITY_____ ZONE_____

STATE_____

here's the easy way to solve

your substation

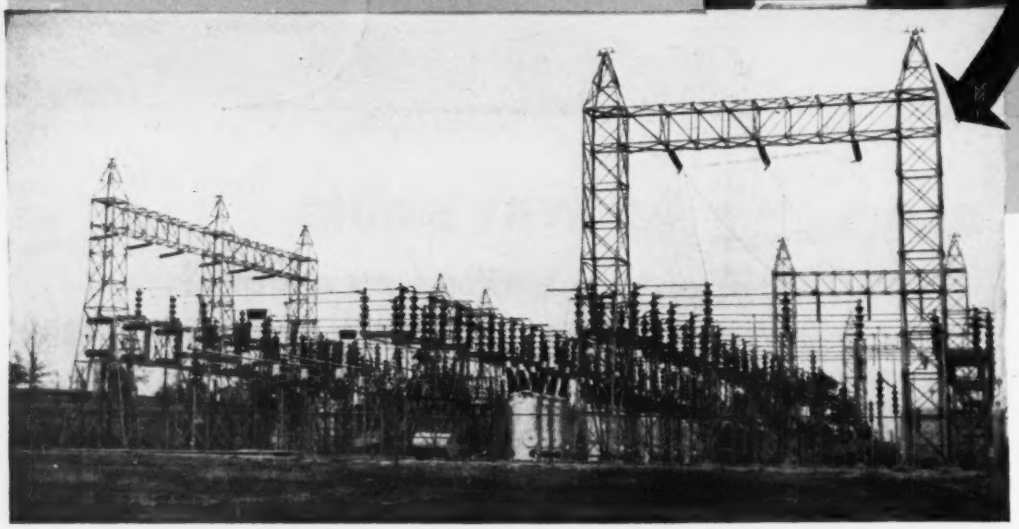
DESIGN PROBLEMS



STEP 1—Make one line diagram with specifications. No station layout required.

STEP 2—Submit to Southern States.

STEP 3—The station shipped to job site ready for erection.



Through the years Southern States' experienced team, skilled in engineering, procurement and manufacturing, has provided **single responsibility service** in meeting your substation requirements. Whether it be detailed engineering or materials ordering for job site delivery, we relieve you and your staff of the many details necessary to coordinate procurement with construction schedules.

Southern States
HAMPTON

SS

Equipment Corp.
GEORGIA

CARBON BLACK TAPES in ANACONDA Type CB Cable keep deterioration products outside dielectric field . . . lengthen cable life.

"Hungry" tapes add life to this cable

Colloidal carbon can purify and stabilize many fluid mixtures—a property important to chemists. It's important, too, to cable engineers. For it can do the same for impregnating oil in paper cables. At Anaconda, tests with cables made with carbon-black tapes proved it!

These tapes are "hungry" for oil-deterioration products created by high heat and electrical stress. They stop ionization discharges. They keep insulating oil "alive." The life span of ANACONDA Type CB* (Carbon Black) Power Cable greatly exceeds that of ordinary impregnated paper-insulated cable. Type CB cables in service over 12 years have proved their superiority.

For greatly extended sheath life of ANACONDA Type CB Cable, specify ANACONDA F-3** alloy. This superior alloy-lead sheath won't age-harden . . . resists slow-bending fatigue, creep, burst and abrasion. Cable joint sleeves also are available in this same alloy. They all offer higher tensile strength, a 50% higher bursting strength than copper-lead, lower creep rate and similar increased resistance to bending fatigue and vibration.

For the full story on this superior, time-tested cable, see your Anaconda Representative. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 53331

*CB — Carbon Black (U. S. Patents 2,102,129, 2,405,853) Reg. U. S. Pat. Off.

**F-3 — Arsenic-Lead Alloy (U. S. Patents 2,300,788, 2,375,755, 2,504,600 and 2,570,501) Reg. U. S. Pat. Off.

ANACONDA®

Service and overhead distribution cables, bare and weatherproof, including ACSR • signal, control and communication cable • portable cords and cables • network cables • airport and series lighting cables • mine cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA

AURORA

HENNEPIN
EASTLAKE
OAK CREEK
MULLERGREN
URQUHART
MILLIKEN
SAGUARO
SUWANNEE RIVER
SANDOW
NELSON
KINGSTON
WILMINGTON
BARRY
JOHN SEVIER
VERMILION
GALLATIN
ISLAND PARK
CARBON

NEW —

Central and Northeastern Minnesota now have available an additional 88,000 kw of electric generating capacity as Minnesota Power & Light Company's new Aurora Station goes "on the line."

This new Steam Electric Generating Station, located just east of Aurora, Minnesota, on Colby Lake and on the main line of the Duluth, Missabe & Iron Range Railway, was begun late in 1950. Ebasco Services, Inc. are the consulting engineers. Initial equipment comprises two 44,000 kw turbo generators and two C-E Boilers.

Completion of the Aurora Station brings the Company's interconnected system total generating capacity to 347,440 kw of which 240,500 kw is steam generated. This represents an increase of 178,554 kw or 106% since the end of World War II.

Situated on Minnesota's famous Mesabi Iron Range adjacent to the world's largest producers of iron ore, Aurora Station is interconnected with the Company's entire system and thus provides electric power even more reliably and in greater abundance not only to the Mesabi Range, but also to the widely diverse needs of the entire region.

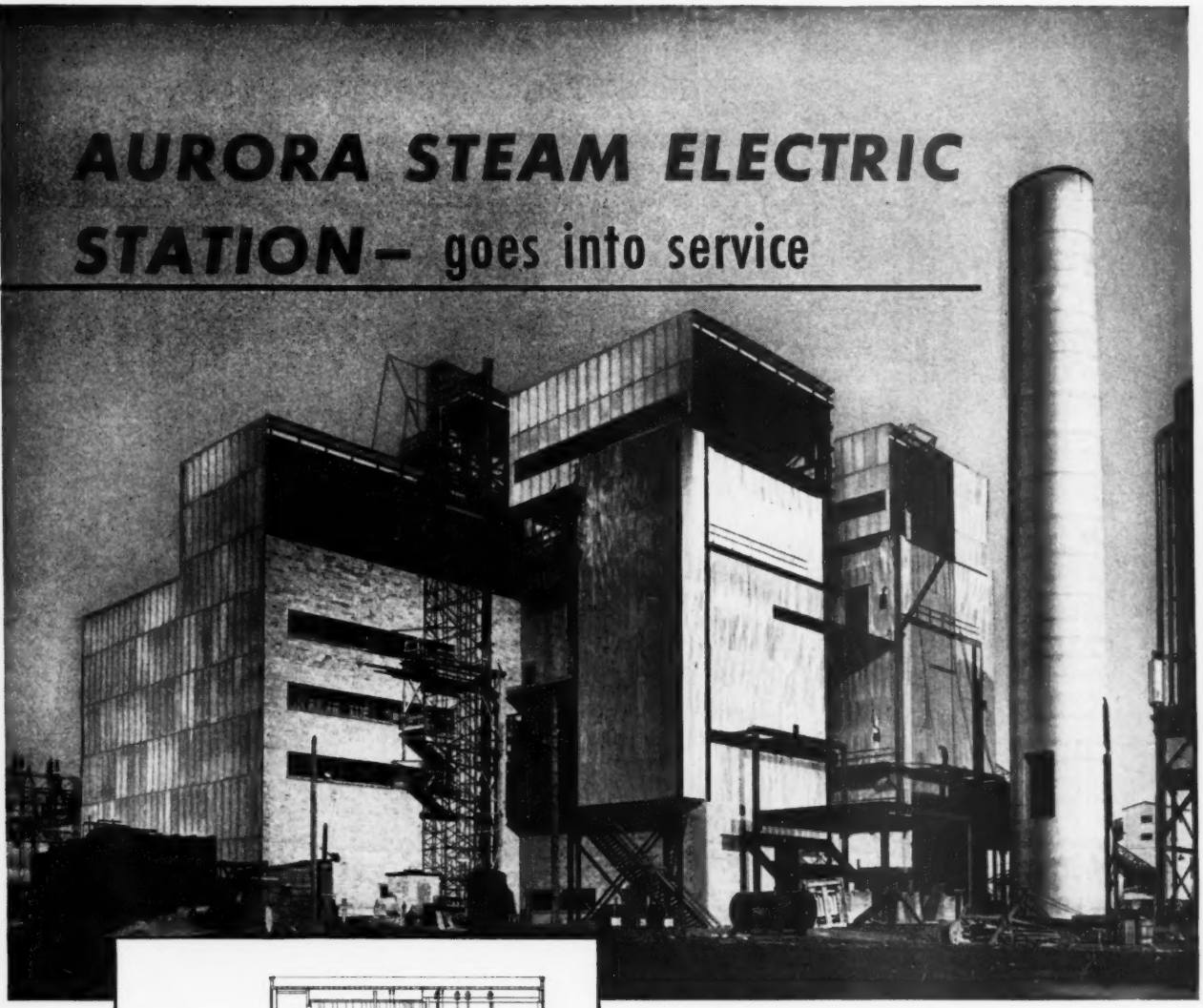
Both of the turbo generators in this new station are served by C-E Steam Generating Units, a brief description and cross-sectional elevation of which appear on the opposite page.

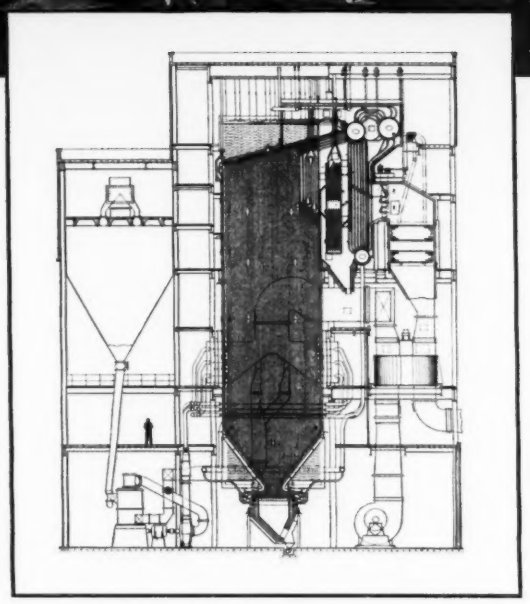
COMBUSTION ENGINEERING, INC.

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

B-690

AURORA STEAM ELECTRIC STATION— goes into service

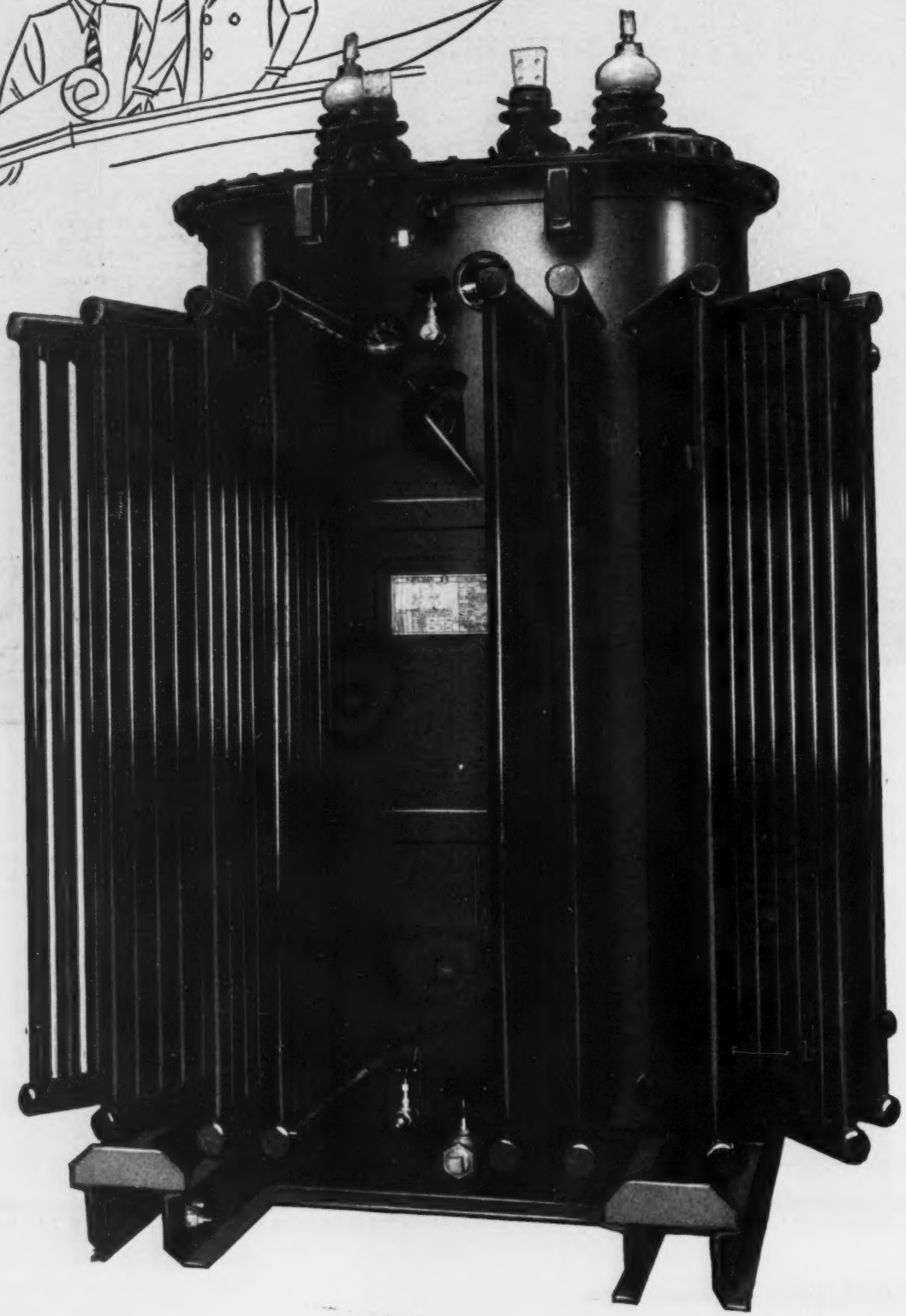




The cross-sectional view at the left shows one of the two C-E Units which supply the new Aurora Station of the Minnesota Power & Light Company. They are 3-drum boilers with 2-stage superheaters and have finned tube economizer surface following the convection bank. Regenerative type air heaters follow the economizer surface. The completely water-cooled furnace is of the basket-bottom type. The units are pulverized coal fired using bowl mills and tilting, tangential burners. Provision is made to use oil as an alternate fuel. Each boiler will supply 425,000 lb of steam per hr at 1350 psi and 955 F.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

Kuhlman gives you



NEMA standards plus...

59 years experience building sturdy, reliable transformers

You can get a transformer that conforms to NEMA Standard almost anywhere. Transformer manufacturers conform to these standards, but you get certain "plus values" when you use Kuhlman power transformers. For instance, the Kuhlman Electric Company has been building transformers since 1894, shortly after the very first transformer was installed at Great Barrington, Massachusetts.

And for 59 years Kuhlman has been designing and building transformers to meet the requirements of utility and industrial users.

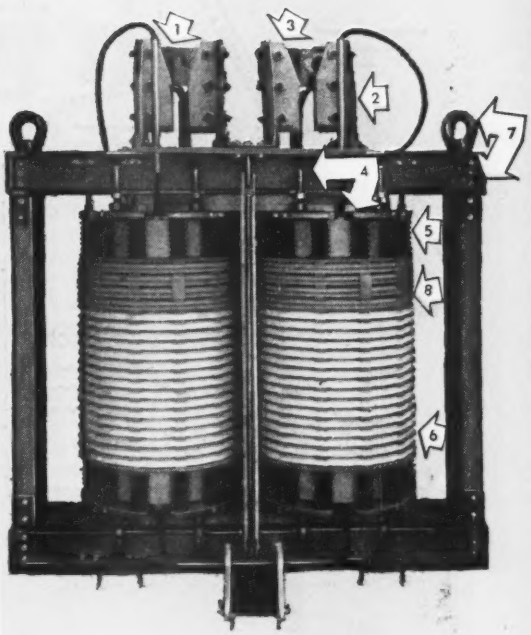
That's a lot of experience. It has resulted in power transformers that not only conform to the minimum NEMA requirements, but which have a high reputation for efficiency, reliability, and functional simplicity. Kuhlman engineers overlook no details in designing and building power transformers which will give you many years of efficient, dependable service. It is chiefly because of Kuhlman's use of approved and accepted design principles, carefully selected and tested materials, painstaking assembly, and thorough testing and inspection that you get a transformer of rigid, sturdy construction — the "plus value" which is the result of 59 years' experience.

The structural steel core clamps, which secure the core-and-coil assembly and anchor it to the tank, are the main source of sturdiness in Kuhlman power transformers.

Lock spacers, inserted between the coil sections, increase the strength of the coil and add to the over-all sturdiness of the transformer.

The tank is made from heavy steel plate. All cooling tubes and seams are electrically welded, providing oil-tight and rust-proof joints. The surfaces are shot-blasted and covered with a rust-inhibitive primer and two coats of corrosion-resistant paint.

Specify Kuhlman for your next transformer installation. Write us for the name of your nearest Kuhlman representative. And for further details about Kuhlman power transformers, ask for Bulletin CS-601.



CONSTRUCTION DETAILS

1. **Tap changer board — made of special heat resistant material developed by Kuhlman. Won't crack under high Class A insulation temperature.**
2. **Terminal board supports — made of grade A press board.**
3. **Fibre bolts — combine high electrical and mechanical strength.**
4. **Clamp jack screws and steel clamping plates — supply easily adjustable coil pressure top and bottom.**
5. **Porcelain blocking posts — offer increased creepage strength.**
6. **Lock spacers — firmly anchored between coil sections add to over-all construction strength.**
7. **Rigid core clamps with lifting lugs — provide mechanical strength and ease of handling.**
8. **Reinforced end coils — protect the transformer from surge potentials.**

Kuhlman

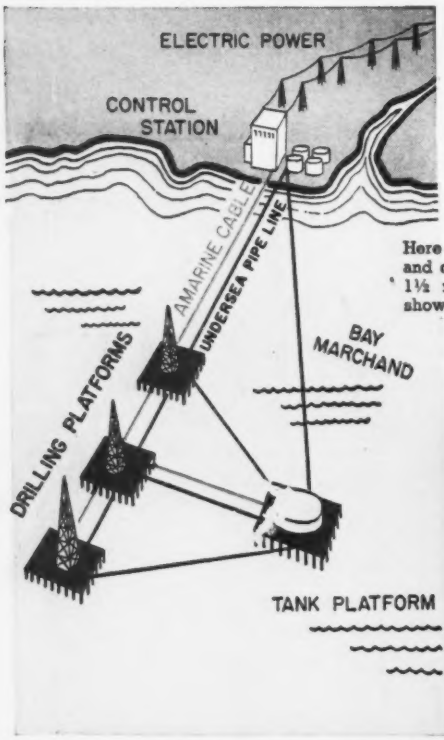
ELECTRIC COMPANY
BAY CITY, MICHIGAN
CRYSTAL SPRINGS, MISSISSIPPI

Export Representatives: *International Standard Electric Corporation,*
50 Church Street, 15th Floor, New York 4, New York
Cable address: Microphone, N. Y.

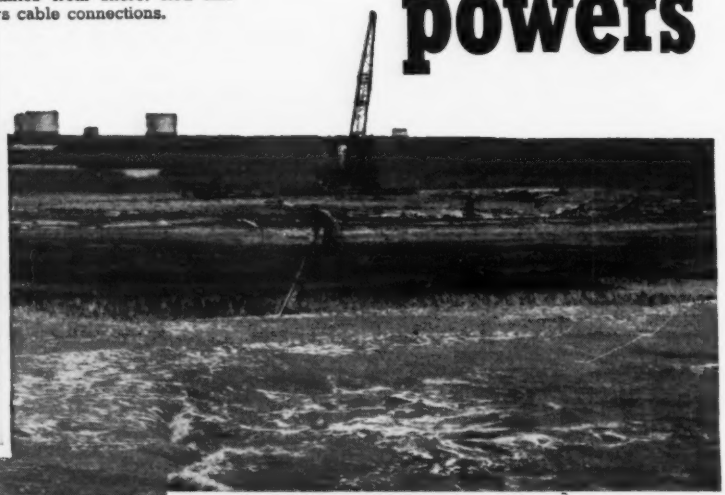
KUHLMAN K E ELECTRIC

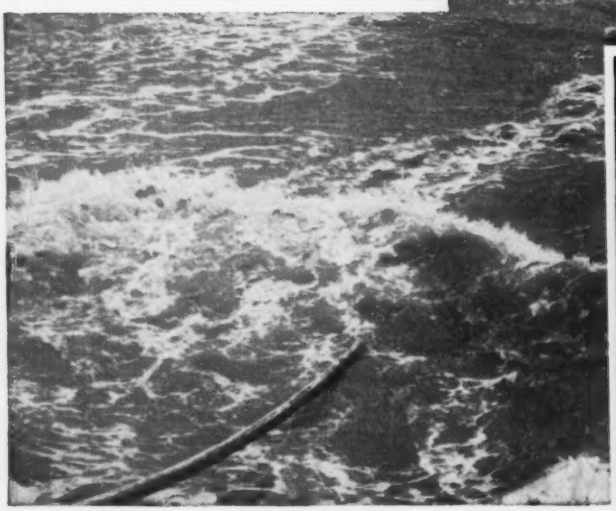
129-A

The first case 4 miles of powers



Here is layout of drilling platform and cable supply. Rig D is about 1½ miles from shore. Red line shows cable connections.





Anchoring cable on shore. Power is supplied at 13,800 volts. Entire cable is armored with galvanized mild steel wire to provide strength, resist abrasion.

Pulling cable onto first platform. Each of the three conductors is covered with PS Shielding to eliminate corona discharge.

AMERICAN STEEL & WIRE DIVISION
USS
AMERICAN ELECTRICAL WIRE AND CABLE
UNITED STATES STEEL

A STANDARD CABLE FOR

▼ asbestos wire and cable ▼ shovel & dredge cable
▼ paper & varnished cambric cable
▼ aerial, underground & submarine cable

U·S·S AMERICAN ELECTRICAL

# of its kind...
Amarine Submarine Cable off-shore drilling rig

• It isn't easy to operate an off-shore drilling rig in the Gulf of Mexico. Fog, northwesters and water spouts are common hazards. Hurricanes are the worst of all.

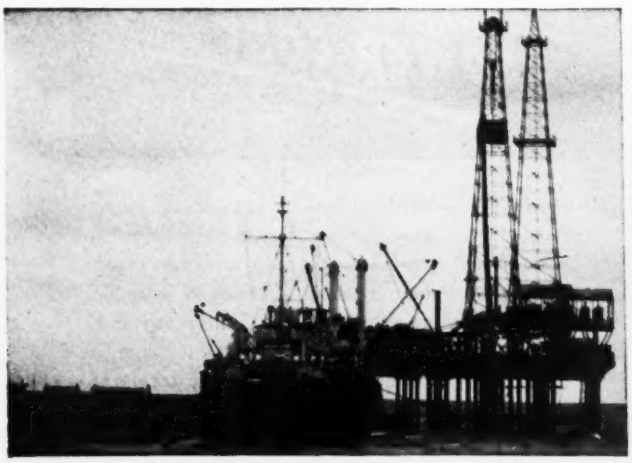
In the face of these difficulties, the California Company brought in 10 producing wells a mile or more from shore. A converted LST supplied power to the pumps—but it was vulnerable to bad weather and it was needed elsewhere, for other drilling operations. What was needed was a *reliable* way to get commercial power out to sea.

American Steel & Wire designed a special non-leaded 3-conductor submarine cable that transmits some 2,500 horsepower to the drilling platforms. In just a single day, it was carried out to the first platform. It is totally unsupported, and lies on the bottom of the Gulf, safe from wind and sea. Now the pumps are operated round the clock with reliable shore power.

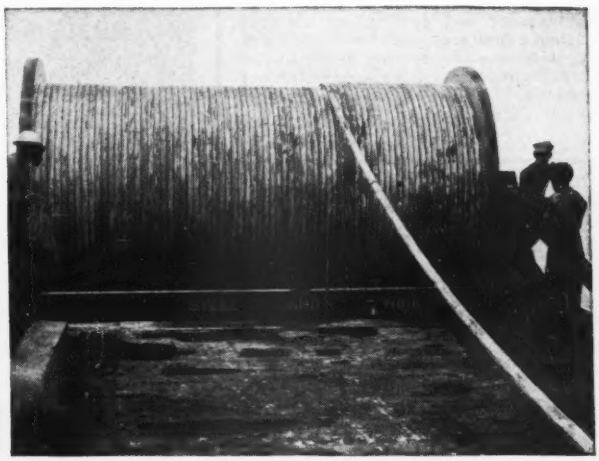
It's the tough jobs like this that have made U·S·S Amarine Submarine Cable famous. And remember, too, that you can get a standard U·S·S American cable for every special job, whether it's for a mining locomotive, dredge, power shovel or a hand-operated electric drill.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Here is typical rig. Notice LST in center, cable barge at left. Cable contains three pairs of telephone wires to communicate between drilling rigs and shore.



Cable was shipped on two reels—12,970 feet on one, 6,500 on the other. We have shipped another 6,000 feet of same cable to join new drilling rigs.

EVERY SPECIAL JOB!

▼ mold cured portable cord
▼ machine tool & building wire
▼ special purpose wire & cable

WIRE & CABLE USS

SEND THE COUPON

American Steel & Wire Division
Room EE-93, Rockefeller Building, Cleveland 13, Ohio

☐ Please give me more information on U·S·S Amarine Submarine Cable.
☐ Have representative call.

Name.....
Title.....
Company.....
Address.....
City.....State.....

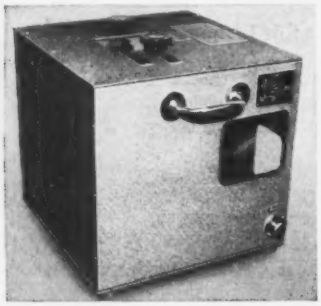
UNITED STATES STEEL

BIDDLE *Instrument News*

NEW HIGH VOLTAGE BRIDGE

Murray Loop Type for Use With Biddle Impulse Cable Fault Locating Transmitters

This new bridge is a high quality, compact, well-designed device to be used for localizing faults on power cables—particularly of the submarine and buried types. It is also useful in the case of duct line construction where water-filled manholes, ice, snow and traffic retard the location of faults by the impulse tracer method.



The entire bridge assembly is mounted in a metal case, 17″ by 17″ by 16″ high. The galvanometer and counter are observed through a clear plastic window in the top of the metal case. An opening in the side of the case gives access to the input and output terminals. The entire assembly weighs about 60 pounds. Write for **BULLETIN 65-W.**

ACCESSORY PICKUP LOOP

for use with Biddle Impulse Cable Fault Locator

In locating faults on buried cables there are cases where records of the exact location of the cable itself are questionable, and the problem becomes one of tracing the cable as well as locating the fault.

A pickup loop has been developed, as shown in the accompanying photograph, which is not only convenient to use in following buried installations, but is critical of any change in direction of the cable. It can also be used to estimate the depth of a cable by placing it on both sides of the cable run and noting the degree of tilt required to obtain a maximum signal. For complete description, write for **BULLETIN 65-W.**

Although designed primarily for use on lead covered cable installed in ducts, Biddle Cable Fault Locators are also used on aerial and buried cable. The new Model 4 Transmitter has a maximum output of 15 kv d-c and a discharge capacitance of 2 muf.

The Model 4 Transmitter requires a source of supply of about 600 va at 115 volts a-c and weighs about 150 lbs. complete with all test leads. Unit can be carried in any ordinary passenger car. It may be used as a source of d-c voltage for proof testing of cable and other insulation, a very valuable feature both at installation and after alterations or repairs. It provides a d-c over-voltage test facility that is particularly suited to cables and other electrical apparatus in the lower voltage classes. It has a maximum proof testing current capacity of 15 milliamperes at about .7 megohms and about 50 milliamperes at short circuit.

The Model 4 Transmitter is a strongly built unit equipped with the highest quality components available, and designed for hard service. The structural parts are a combination of steel and aluminum with the exterior finished in grey enamel hammertone finish.

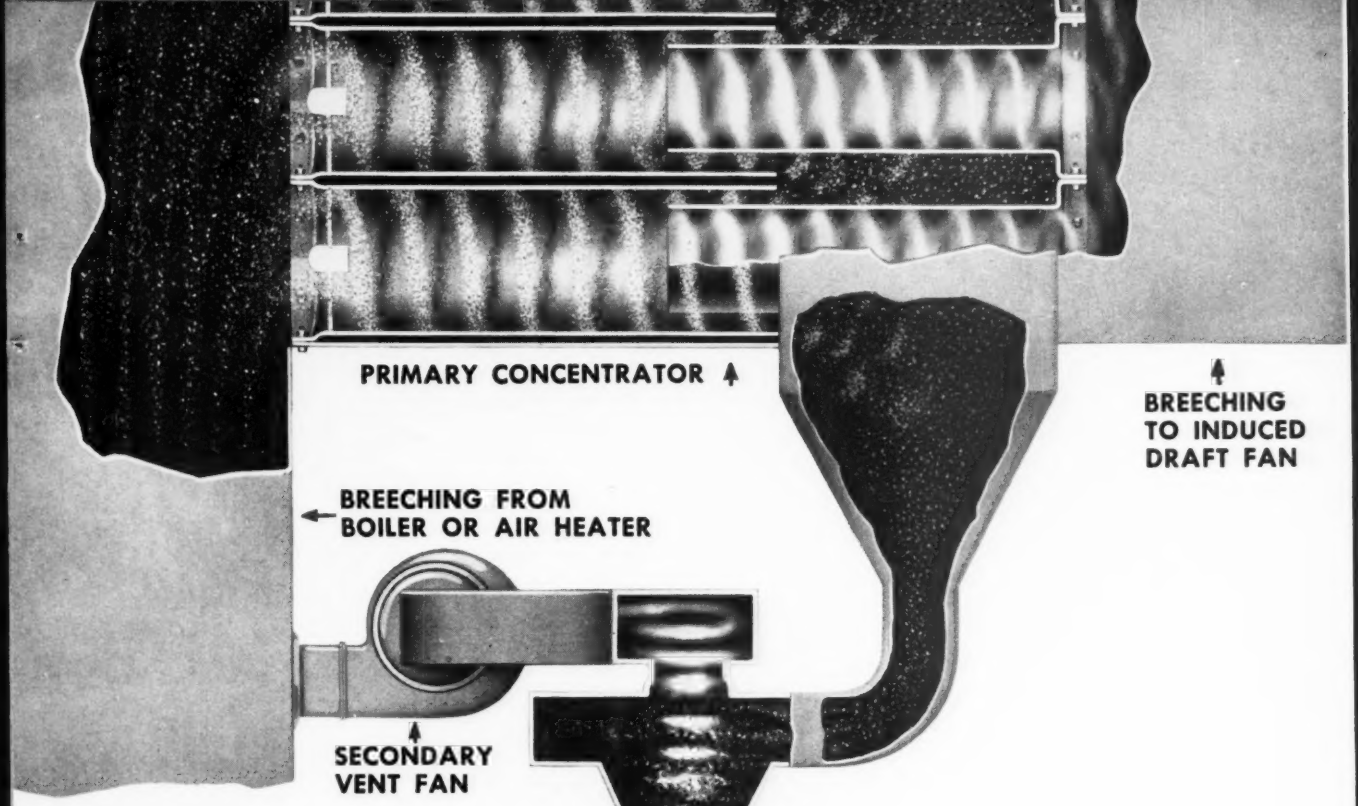
For complete information on Biddle Cable Fault Locator equipment, write for our new **BULLETIN 65-W.**

B-935

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

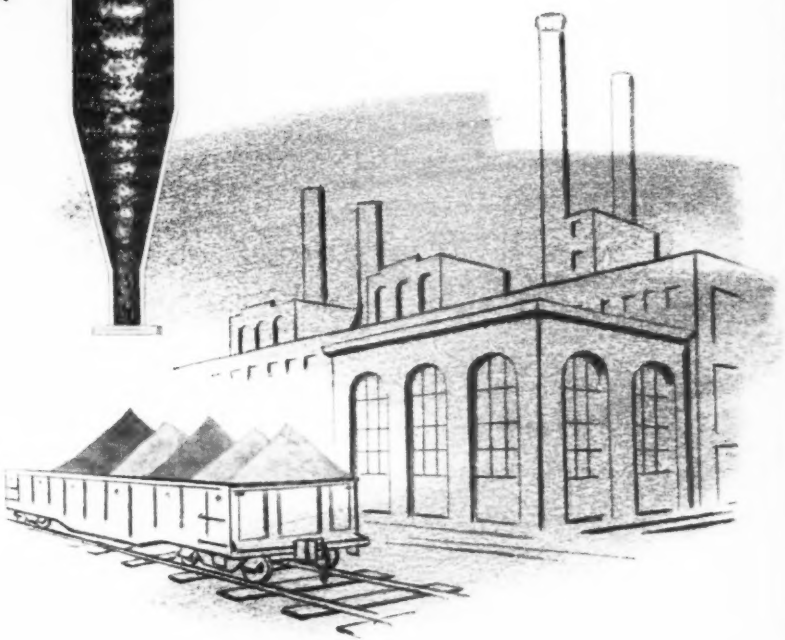

PRIMARY CONCENTRATOR
BREECHING TO INDUCED DRAFT FAN
BREECHING FROM BOILER OR AIR HEATER
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

Simplest way to solve your fly-ash problem

Install a Type ST Fly Ash Precipitator like that shown above.

On a given application, as the load falls off and fly ash becomes more difficult to catch, the ST Precipitator automatically maintains higher efficiency than any other collector of mechanical type.

Contact the nearest of many American Blower and Canadian Sirocco Branch Offices, strategically located throughout the United States and Canada, for complete information on Type ST Fly Ash Precipitators.



AMERICAN BLOWER

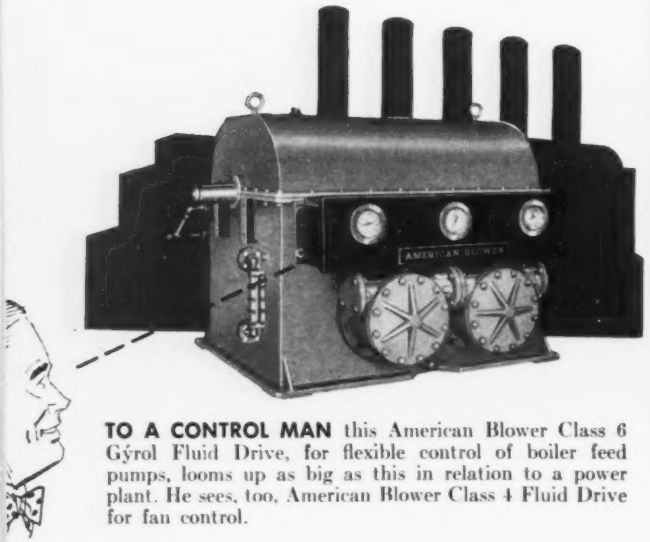
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

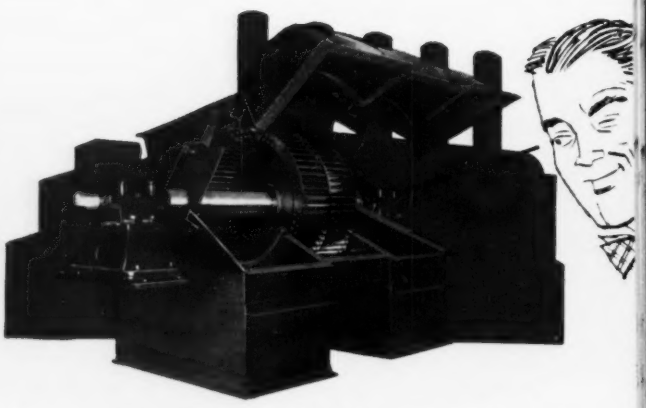
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER

It all depends on how you look at it

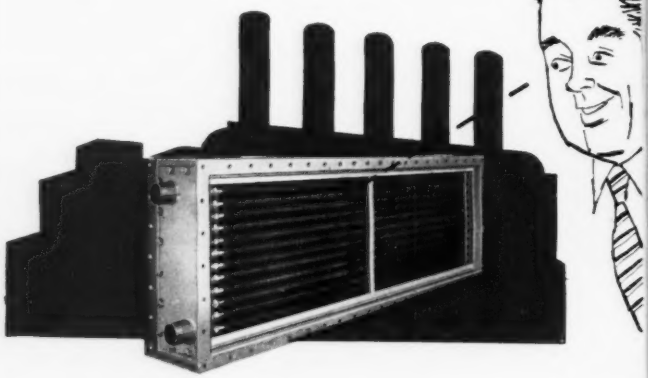


TO A CONTROL MAN this American Blower Class 6 Gýrol Fluid Drive, for flexible control of boiler feed pumps, looms up as big as this in relation to a power plant. He sees, too, American Blower Class 4 Fluid Drive for fan control.



TO A MECHANICAL DRAFT MAN a Sirocco Multi-Blade Fan, which delivers more gas per revolution than any other type, takes *this* proportion in the picture. He could see an American Blower HS Fan equally large if thinking of forced draft.

TO A FLY ASH EXPERT an American Blower Type ST Fly Ash Precipitator looks like this in relation to the rest of the power plant. Little wonder, for the Precipitator lifts a load off his shoulders and minimizes a nuisance.



TO A COIL MAN American Blower Heavy Duty Steam Coils would appear like this in his power plant picture. He likes their great strength, easy accessibility and the way they withstand the high pressures of heavy loads.

Looking at your complete power plant picture, we believe you'll find, as hundreds of others have, that all these American Blower Products improve over-all power-plant efficiency and insure years of dependable operation. Call our nearest Branch Office for complete data.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

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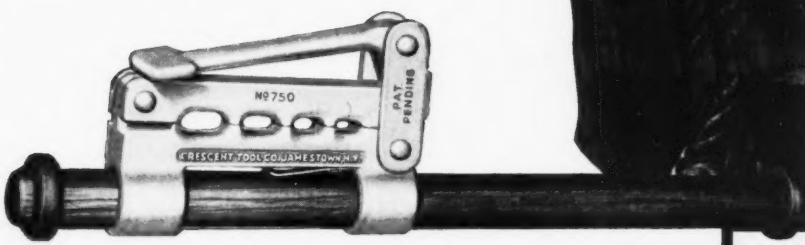
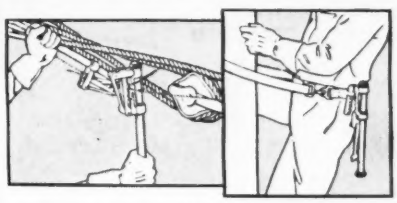
CRESCENT SLEEVE WRENCHES

PRODUCE BETTER JOINTS FASTER... SAFER



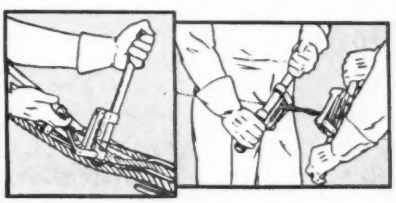
● Crescent No. 750 Sleeve Wrenches not only produce a far better sleeve joint but definitely reduce working hazards. Oil-impregnated hickory handles assure almost perfect insulation, prevent flash if contacted with hot wire. Design of the openings is such that maximum strength of the joint is assured. For use with single or double tube sleeves . . . available in over 375 different opening combinations. Order in pairs from your supply house, or write us for complete information.

INSURE 90-98% PERFECT JOINTS



SLIDING HANDLE CLEARS TACKLE. NO UNCLAMPING

HANGS SECURELY IN BELT



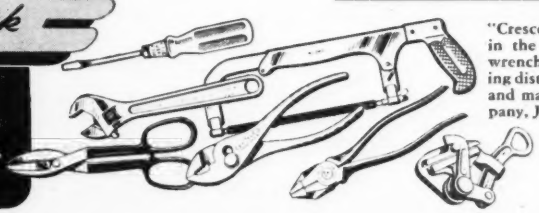
READILY RELEASED WITH ONE HAND

SIX FULL TURNS WITHOUT DAMAGE TO SLEEVE

CRESCENT TOOL CO., JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
Symbol of Excellence

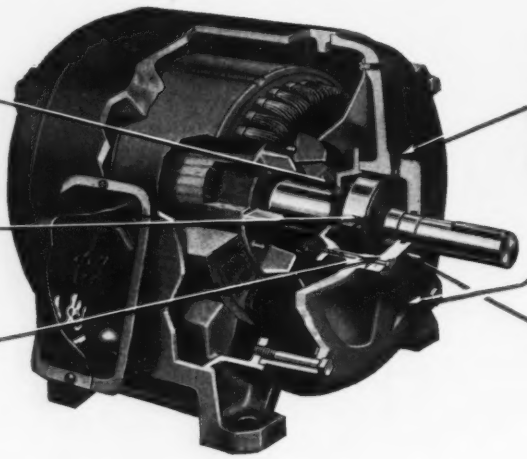


"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N.Y.

Here Are Facts You Should Know About Electric Motor Bearings

An ideal motor bearing would operate for indefinitely long periods under all types of conditions without requiring any attention whatever. However, in the opinion of our engineers, such a bearing and its attendant lubricant are not yet available on the commercial market. Consequently, bearings for many types of operations, particularly where overloading, extreme temperature ranges and chemical and dirt laden atmospheres are involved, require special lubricants or regular lubrication schedules.

Of course, bearings suitable for many kinds of operation under normal conditions can be built to require no attention for very long periods — usually several years. Allis-Chalmers can supply sealed bearings in all frame sizes through 505 on short delivery and without extra cost for applications of this type.


Bearing cap and seal
Double-shielded bearing
Large grease reservoir
Plugged and tapped holes for grease and pressure relief
Labyrinth grease seal

Which is the Best Design for *Your* Application?

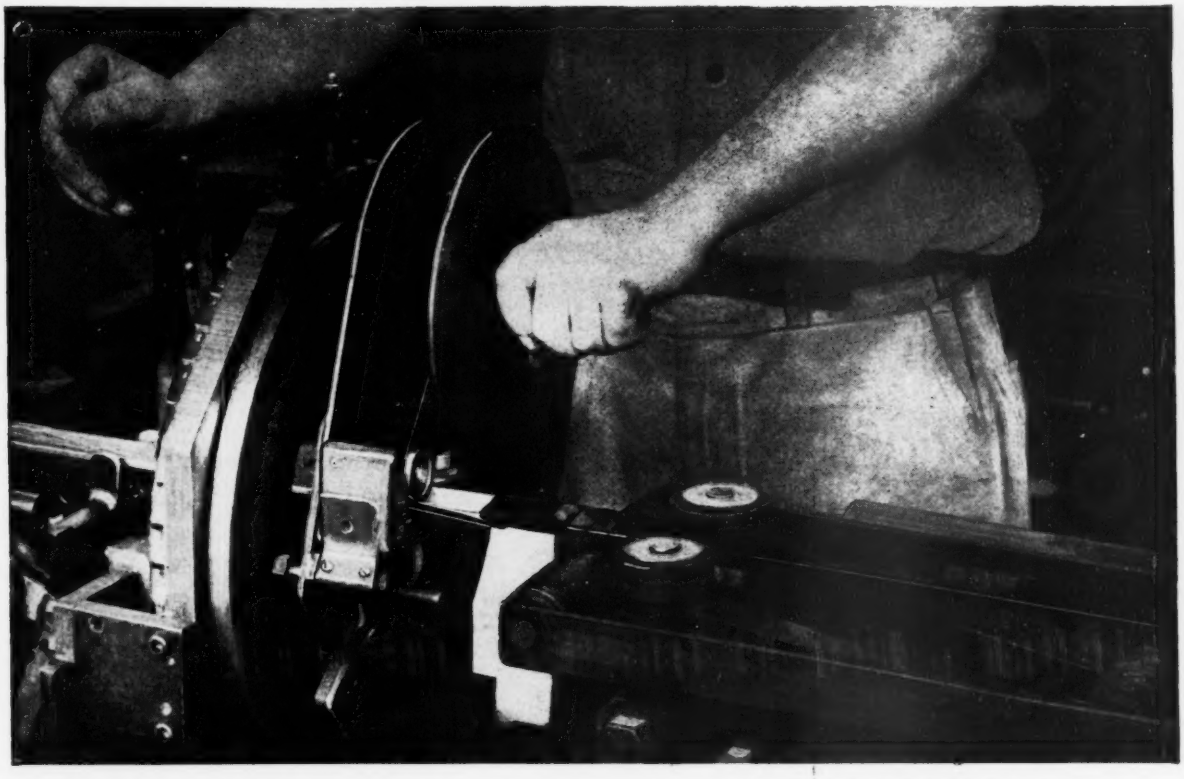
We believe that the design used in standard Allis-Chalmers drip-proof, tefc and explosion-proof motors represents the best design for most industrial users.

The Allis-Chalmers standard design consists of a pre-lubricated, double-shielded bearing mounted in the end housing with a generous grease reservoir. Plugged and tapped holes are provided for grease and for pressure relief. Under normal operating conditions, this design will operate as long without attention as any other type of bearing in use today. But where difficult operating conditions make re-lubrication desirable, it can be done as part of the normal lubricating-routine without dismantling the motor.

The large grease reservoir and shielded bearing design assure that grease lost from the bearing due to high operating temperatures or other causes will be replaced automatically.

For further information on bearing design and other features of Allis-Chalmers motors, call your nearby Allis-Chalmers District Office or Authorized Distributor. A-4130

ALLIS-CHALMERS



Wrap bus bars quickly, easily, with IRVINGTON heat-and oil-resistant TEMFLEX® 105 Tape

With its high modulus of elasticity, Irvington's Temflex 105 Tape is exceptionally suitable for use in taping heads to produce close, carefully lapped wraps on bus bars or other conductors — without excessive elongation of the tape.

Flexibility, strength and excellent elongation make Temflex 105 Tape equally adaptable to the *hand* wrapping of irregular surfaces — such as cable splices or joints in bus bars. Tape bakes easily to a homogeneous mass — effects substantial economies over other types.

Temflex 105 Tape offers unusual resistance to heat and oil — it is based on the same formula that has made Temflex 105 Plastic *Tubing* the standard wherever service calls for continuous operation in air at 105° C., or in oil at 90° C.

Look to
IRVINGTON
for Insulation Leadership

INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

Get the full facts on characteristics and application of this Irvington insulating material — mail the coupon for technical data sheet.

Send this convenient coupon now

Irvington

VARNISH & INSULATOR COMPANY
21 Argyle Terrace, Irvington 11, New Jersey
Plants: Irvington, N. J.; Monrovia, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company EW 9/53
21 Argyle Terrace, Irvington 11, New Jersey

Gentlemen:

Please send me technical data sheet on Temflex 105 Tape.

Name..... Title.....
Company.....
Street.....
City..... Zone..... State.....

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS

1. Low burden—the lowest burden of any round-chart recorder on the market.

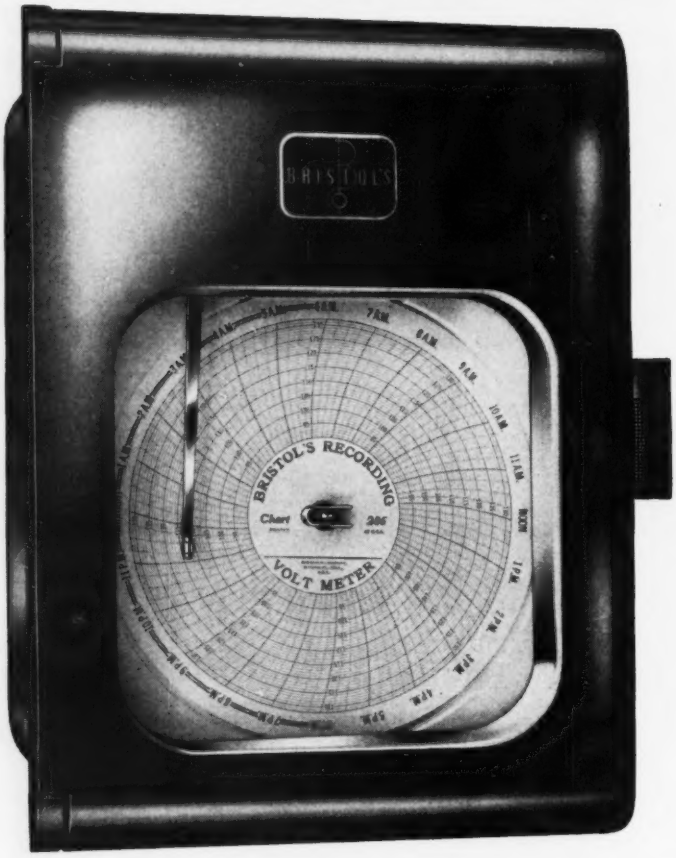
2. Extremely high torque gradient.

3. Temperature compensated.

4. Shock-proof moving element mounting.

5. Leveling of instrument not critical.

6. Continuously legible recording on sudden changes—up to full scale value.

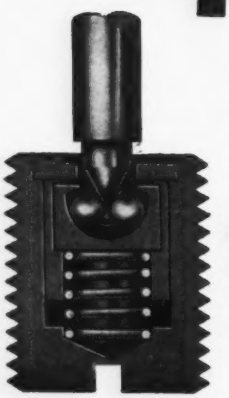


Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.



Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

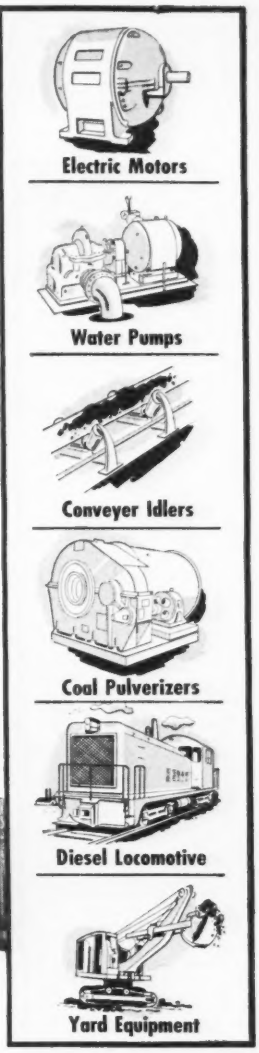
New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

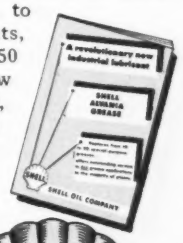
3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

• • •

The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



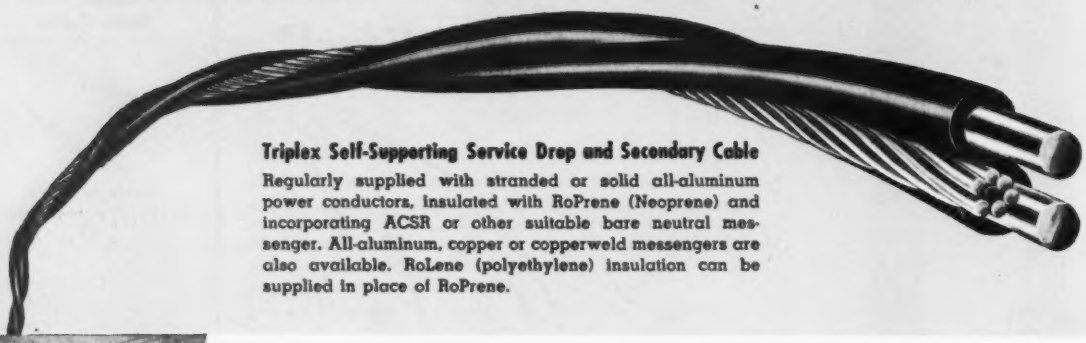
SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

SHELL

Rome Aluminum Triplex

offers you a host of cost advantages

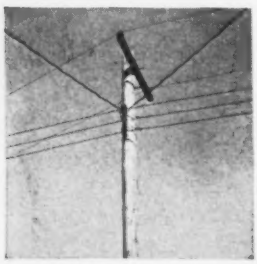


Triplex Self-Supporting Service Drop and Secondary Cable

Regularly supplied with stranded or solid all-aluminum power conductors, insulated with RoPrene (Neoprene) and incorporating ACSR or other suitable bare neutral messenger. All-aluminum, copper or copperweld messengers are also available. RoLene (polyethylene) insulation can be supplied in place of RoPrene.

Provides neat, clean looking installation in new homes area.

Less subject to damage by storm and falling tree limbs.



Installation at pole and house is easy and quick.

Many applications of Rome Aluminum Triplex secondary and service drop cable show outstanding cost advantages over conventional bare or weatherproof open wire construction.

For one thing, by proper mechanical design it may eliminate one-third to one-half the number of poles normally required. This adds up to a substantial saving. Further, it is also possible to utilize mid-span connections for service drops.

Rome Aluminum Triplex is particularly desirable for new residential developments. Neat in appearance, while mechanical design and light weight minimize sag tendencies. This cable construction, with its strong messenger, affords greater protection against wind and ice loading damage.

Fewer accessories are needed for secondary and service drop connections than for open wire construction. Maintenance is less costly; conductors are easily accessible.

Longer service life is assured because of mechanical design. RoPrene (Neoprene) and RoLene (polyethylene) insulation have exceptional resistance to weather and all climatic conditions. There are no braids to rot or festoon. Replacement is minimized.

So whether it's secondary or service drop cable or weatherproof wire for distribution, Rome Aluminum offers you a host of advantages. May we send you samples?

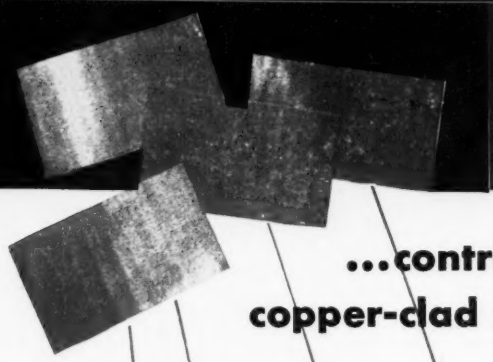
Rome Weatherproof Wire

Regularly supplied with solid or stranded all-aluminum or ACSR conductors, covered with RoLene or RoPrene. Conventional URC triple braid covering can also be supplied.

Rome ALUMINUM

It Costs Less to Buy the Best

ROME CABLE CORPORATION, ROME, N.Y., AND TORRANCE, CALIF.



NATIONAL VULCANIZED FIBRE

...contributes to an improved product— copper-clad Peerless Capacitors for Bendix Radios

These copper-clad Peerless capacitors are used by the Bendix Radio Division, Bendix Aviation Corp., on the voice coil circuit and power input lead of their automobile radios. The capacitor is a combination of Peerless Insulation .004 inch thick copper-clad on both sides with .00135 inch copper foil. Punched clean, Ohmeter tests indicate no shorts between the copper foil surfaces. A minimum capacitance of 200 mmf is obtained.

This practical use of Peerless Insulation, a paper-thin grade of National Vulcanized Fibre, is typical of the countless contributions made by *the material of a million uses*—National Vulcanized Fibre—to business and industry.

National's Peerless Insulation was the *first* fish paper and has been accepted as standard ever since. It is smooth, strong and has excellent forming qualities. Write for detailed literature and engineering service information—

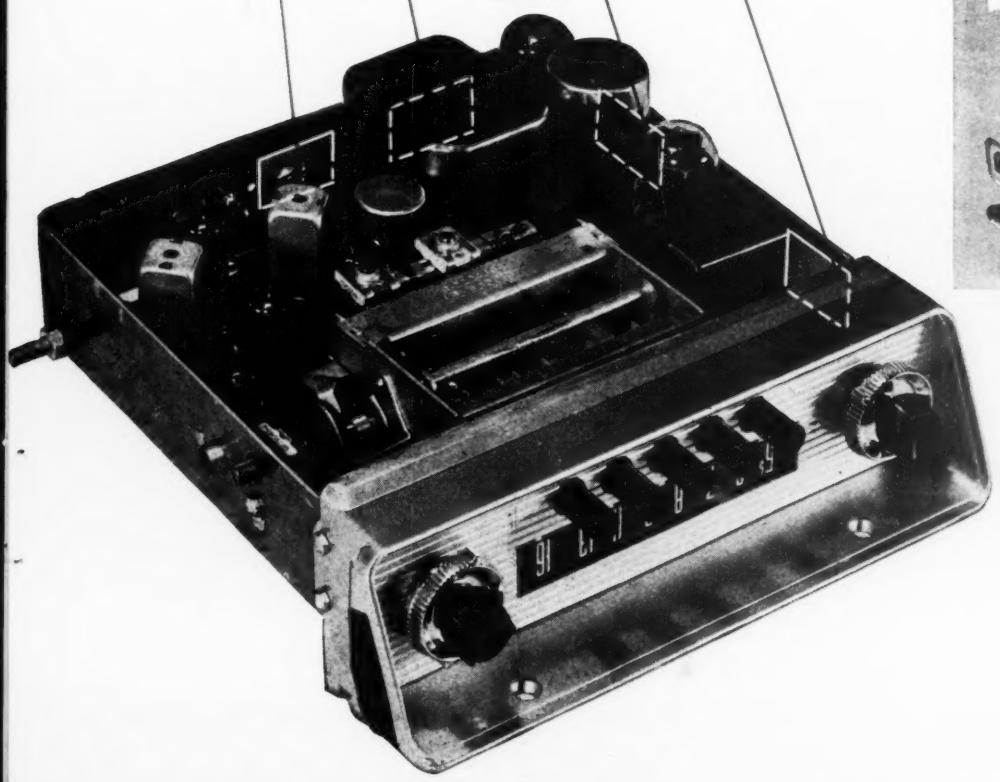
NATIONAL VULCANIZED FIBRE CO.

Wilmington Delaware

Offices in Principal Cities

Since 1873

National Laminated Plastics
nationally known—nationally accepted



Peerless Insulation, possessing high dielectric strength plus excellent rigidity, is copper-clad on both sides to make these capacitors. The punched parts, selling for approximately 7/10 of one cent, replace commercial types of capacitors costing five or six cents.

RESISTANCE GOES DOWN...

PERFORMANCE GOES UP

when you Deep Ground

with

Copperweld TRADE MARK

SECTIONAL GROUND RODS

LET'S LOOK AT THE RECORD!

Here are a few typical results of tests, made throughout the country, showing how good grounds are obtained by deep grounding with Copperweld Sectional Ground Rods.

Location	Resistance Of First 8' Section—Ohms	Resistance Of Deep Ground—Ohms	Depth Of Deep Ground—Feet
Springfield, Mass.	3000	20	48
Petersburg, Va.	400	4	62
Tampa, Fla.	100	6	22
Youngstown, Ohio	35	6	40
Jackson, Mich.	250	6	30
Alton, Ill.	210	6	72
Brainerd, Minn.	500	5	33
New Orleans, La.	200	5	64
Corpus Christi, Tex.	400	3	24

To get low-cost, dependable grounding protection, leading engineers are using Copperweld* Sectional Ground Rods driven deep to reach the strata of better conducting soils.

The above chart shows the lower resistances obtained by deep grounding with Copperweld Sectional Ground Rods. But, it's only part of the story. The companies employing deep grounding have reduced interruptions on their overhead systems. They report fewer transformer failures and blown fuses, as well as less burn-outs of meters and other equipment. Think of what this means in savings, in safety, in better operating performance and improved customer relations!

With Copperweld Sectional Ground Rods, deep grounding is simple, efficient and economical. And, only Copperweld Rods have a stiff steel core for easy driving, with a MOLTEN-WELDED copper exterior providing conductivity and protection against corrosion.

Remember, top performance and low resistance go hand-in-hand. To obtain low resistance economically, drive deep with Copperweld Sectional Ground Rods.

*Trade Mark

THEY'RE MOLTEN-WELDED Copperweld GROUND RODS

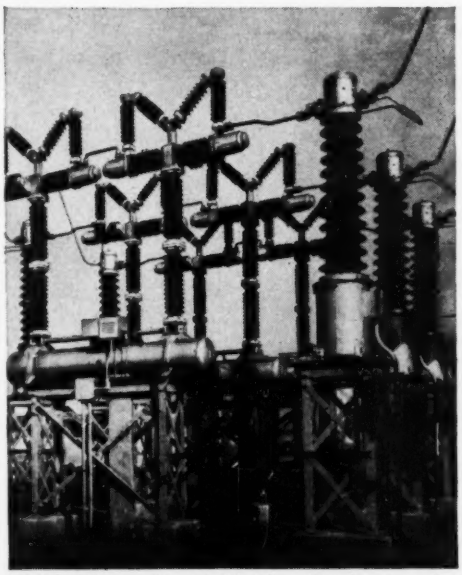
COPPERWELD STEEL COMPANY

Glassport, Pa.

SALES OFFICES IN PRINCIPAL CITIES

IT'S FACTS THAT SELL

BROWN BOVERI AIR BLAST BREAKERS



138 kV Brown Boveri Air Blast Breaker in substation of Public Service Electric & Gas Company.

HERE ARE THE FACTS:

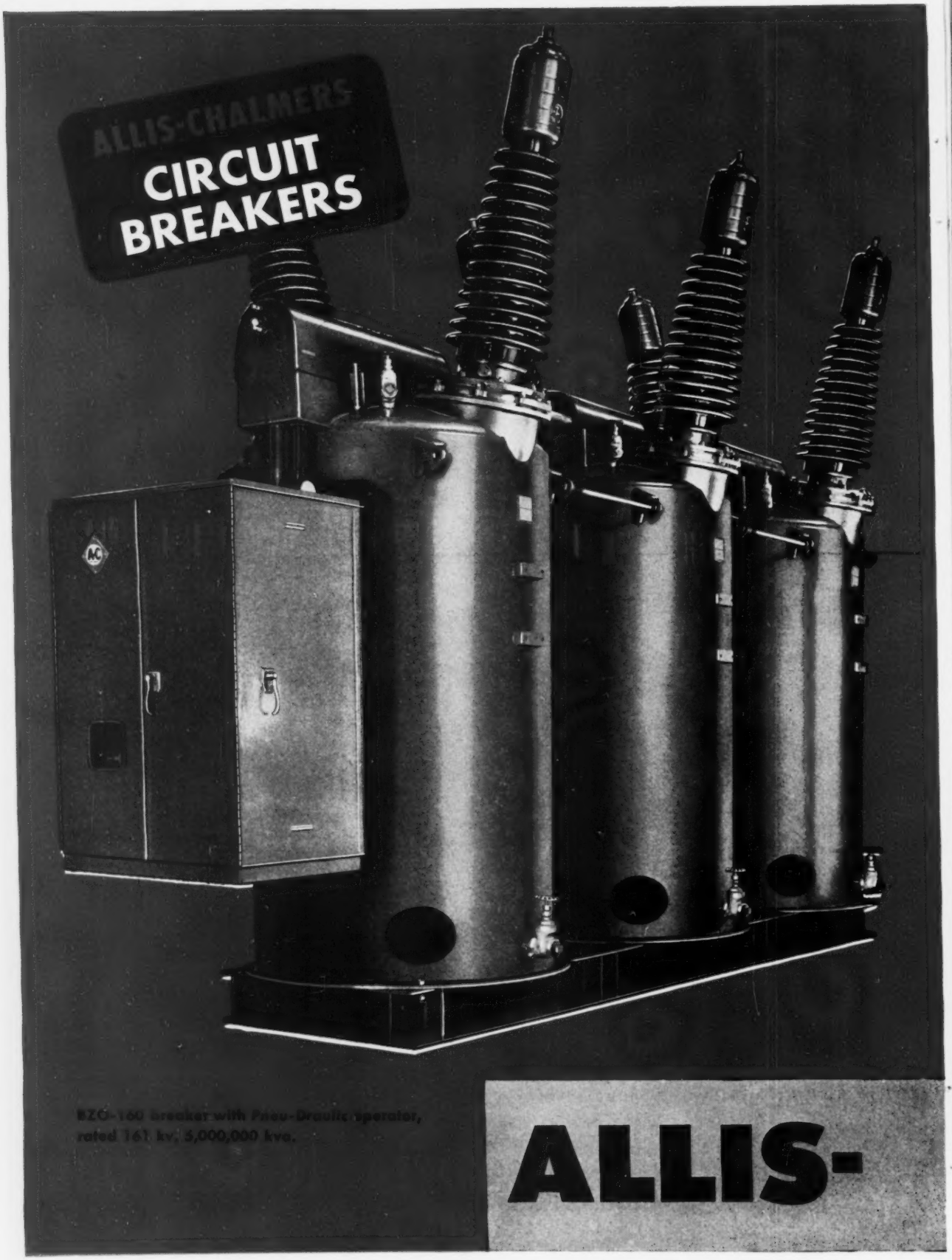
Only Brown Boveri Air Blast Breakers have ALL these advantages:

1 — PROVEN DEPENDABILITY
2 — HIGH INTERRUPTING CAPACITY
3 — HIGH CURRENT CARRYING CAPACITY
4 — HIGH SPEED
5 — RAPID RECLOSING
6 — POSITIVE INTERRUPTION UNDER ALL CONDITIONS
7 — SAFETY
8 — AMAZINGLY LOW INSTALLATION COST
9 — RAPID & EASY INSPECTION
10 — MINIMUM MAINTENANCE
11 — LOW INITIAL COST & PROMPT DELIVERY

FACTS like these are the reasons why more and more utilities, cooperatives, municipalities and industrial organizations are standardizing on Brown Boveri Outdoor and Indoor Air Blast Breakers. Get the complete details. *Write for them today!*

BROWN BOVERI

BROWN BOVERI CORPORATION
19 RECTOR STREET, NEW YORK 6, N. Y.



BZG-160 breaker with Pneu-Draulic operator, rated 161 kv, 5,000,000 kva.

All Breakers Completely Assembled

PRIOR TO SHIPMENT

Installation of Allis-Chalmers Breakers is FAST... EASY

Every detail gets thorough going-over in factory. For example: every breaker is completely assembled and test operated. Parts are marked for alignment — numbered — tagged — for easy, fast field assembly.

Breaker quickly installed — no guesswork — no delays!

Reliability is another feature! Allis-Chalmers breakers in all sizes, all types of operators are full mechanically trip-free. Breaker trips instantly at *full speed* even when operator is closing.

To get these important features on your breakers — specify Allis-Chalmers.

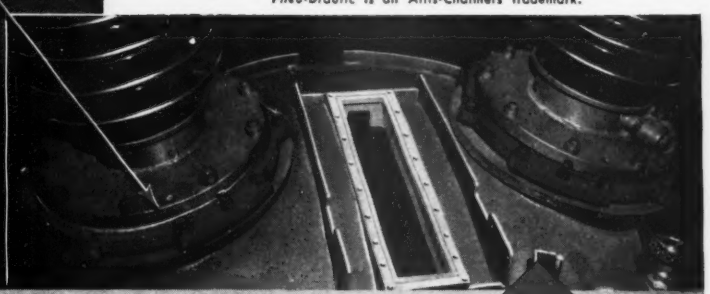
For complete breaker story, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

The Secret of FAST Contact Alignment

Adaptor ring eliminates time loss in alignment. Adaptor rings and bushings are factory aligned and marked for ease of installation during field assembly. Adaptor rings are left in position during shipment. Field assembly time is greatly reduced. Bushing seat gaskets are properly weather sealed by tightly secured bushing flange bolts.

A-4152

Pneu-Draulic is an Allis-Chalmers trademark.

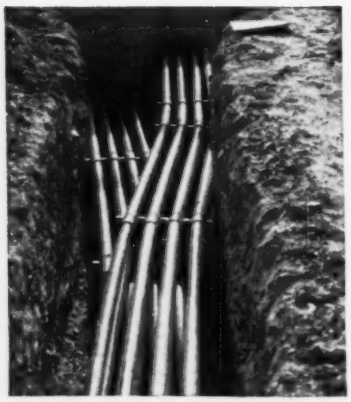


CHALMERS

A-C ALLIS-CHALMERS

ORANGEBURG QUALITY FEATURES

Orangeburg Fibre Conduit is non-metallic — does not corrode. Lasts indefinitely. Impermeable walls and tight joints keep out corrosive ground waters. Smooth bore and low coefficent of friction protect cables from sheath abrasion. Resists acids, alkalis, salt, grease, oil. Tough, resilient. Lays faster at lower cost than any other type of conduit.



STANDARD *is installed with concrete encasement. Preferred for banks of three or more ducts.*

NOCRETE *is installed without concrete encasement. Extra heavy wall for direct burial—practical for many single or double duct runs.*

Utility Engineer's Standby For 60 Years

Leading public utilities and municipalities have used Orangeburg Fibre Conduit extensively for years. It's helpful to know why. The *long-term* protection that Orangeburg gives to cables underground helps the Electrical Industry to keep the *power flowing*—and *saves money* by prolonging cable life. Orangeburg also saves money in every phase of installation. The *standard fittings* supplied for *Orangeburg Conduit* likewise cut down costs by *simplifying installation.* Send to Dept. EW-93A, for complete catalog. Orangeburg Manufacturing Co., Inc., Orangeburg, New York.

ORANGEBURG® **STANDARD** WITH CONCRETE
NOCRETE WITHOUT CONCRETE
FIBRE CONDUIT

GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY
A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

SQUARE D *Reduced Voltage* STARTERS

One of these 4 types will meet your requirements . . . best

- Is minimum motor current inrush your primary consideration?
- Is it reduced starting torque? Or maximum smoothness in acceleration?
- Is cost an important factor?

With these four types Square D can meet any reduced voltage starter requirement—exactly.

Write **for Reduced Voltage Starter Bulletins. They give complete details.**
Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953

THIS OIL PURIFIER NEVER QUITS ON THE JOB!

SPECIAL FEATURE OF THE DE LAVAL PORTABLE OUTFIT	WHAT THIS MEANS TO THE POWER ENGINEER
✓ A De Laval Portable Outfit operates at constant high purifying efficiency. It need not be shut down during a run for renewal of essential parts.	✓ A greater output of dehydrated insulating oil obtained at maximum operating economy.

Constant high purifying efficiency–no shutdowns for cleaning or for renewal of parts during run ✓

Dehydrates at a single pass–no re-running

Higher daily capacity of insulating oil saves maintenance costs ✓

Heater cannot carbonize the insulating oil

Safest–continuous discharge of water prevents re-contamination of the insulating oil ✓

Centrifugal purifier is economical to operate

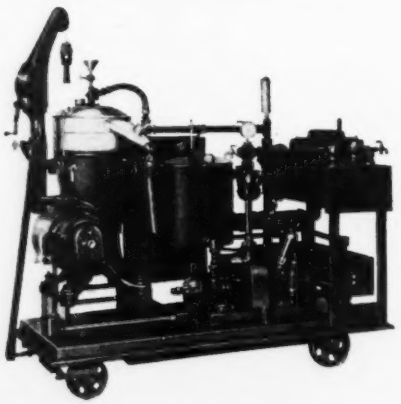
Removes free water without aid of filter press; press used only to remove colloidal carbon ✓

Low temperature purification; high dielectric value of oil maintained longer

Of all the ways there are to purify insulating oil, none is more safe and sure than the De Laval centrifugal method. De Laval Insulating Oil Purifiers promptly and continuously separate oil and water by applying centrifugal force in the bowl of the Purifier. So thorough is this method of purifying oil that not so much as one part of water in 100,000 of oil will remain after purification.

Moreover, De Laval Oil Purifiers remove water at constant high efficiency. No shutdowns are required during the course of a run for cleaning or for renewal of functional parts. This results in time saved and lower operating costs.

Ask for Bulletin TR-1.



✓ CHECK THESE DE LAVAL SUPERIORITIES

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

INSULATING OIL PURIFIERS

Consider the Atomic Power Plant...

when critical piping is the order!

TODAY'S OPERATING TEMPERATURES and pressures so closely approach the maxima for available piping materials that nothing can be left to chance . . . to empirical design. And detailed mathematical calculations to determine all the stresses in a modern, complicated piping system is a herculean task.

However, Kellogg's model tester, employing patented electrical measuring heads (illustrated) fulfills the need for rapid, exact testing for all forces and moments in a proposed system. An added advantage in this method is that changes in design indicated during testing can be immediately incorporated in the model—and testing continues reflecting the effect of the changes in design on all other phases.

While Kellogg's model tester has been used primarily on central station systems (piping arrangements for a total of some 4,700,000 KW's have been investigated to date), it is no wonder that the equipment was again called upon when the power plants for the first atomic submarines were being designed.

All the facets of these extremely critical piping systems—considerably complicated by the confined space within submarines—were thoroughly checked and rechecked on the model tester to assure the operational soundness of the design.

This approach to the problems of high-pressure, high temperature piping—the desire to be sure, to explore new testing techniques, and to constantly improve welding procedures—is Kellogg's basic stock in trade. Many power station designers and utility companies also say it's the basic reason why they repeatedly specify "*critical piping by Kellogg.*"

NEW K-WELD PROCESS . . .
Send for descriptive literature about the new K-Weld process which assures complete penetration without the use of backing rings.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING . . .

- Niagara Mohawk Power Corp.
- Palestine Electric Corp., Ltd. (Israel)
- Philadelphia Electric Co.
- Public Service Co. of Northern Illinois
- Public Service Electric & Gas Co. of N. J.
- Societe Anonyme John Cockerill (Belgium)
- Societa Edison (Italy)
- Societe Financiere De Transports Et D'Entreprises Industrielles (Sofina) (Belgium)

OTHER FABRICATED PRODUCTS including: Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchanger . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Concrete and Radial Brick Chimneys

For further information, details or methods, etc. contact

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY
225 Broadway, N. Y. 7, N. Y.
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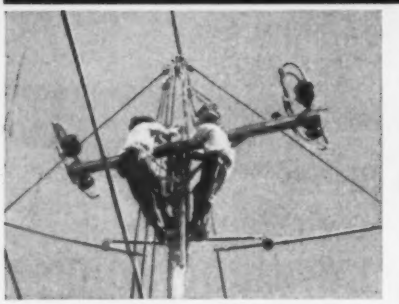
Tulsa, Houston, Toronto, London and Paris

KELLOGG subsidiary of PULLMAN INCORPORATED

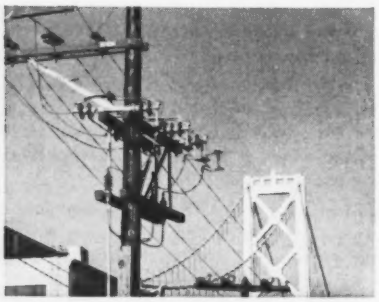
KPF

AIR BREAK SWITCHES

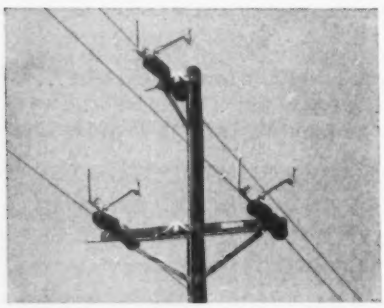
Standard for nearly half a century



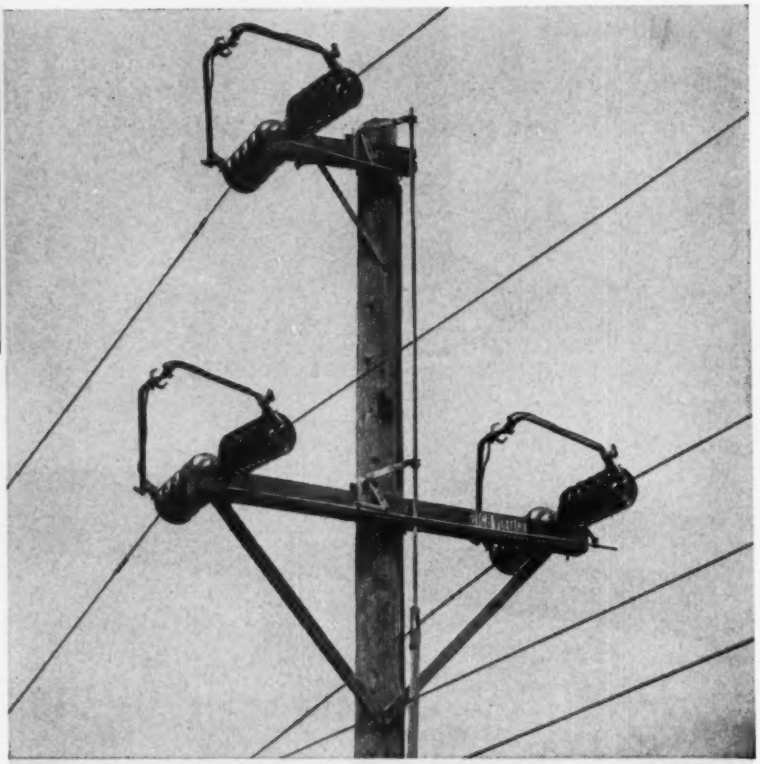
Installing KPF Type A-202 switch hot on 12 kv line. KPF phase units are shipped completely assembled, ready for quick installation.



Horizontal-mounted KPF Type UF-2 switch in metropolitan service (P.G.&E., San Francisco). Versatile KPF switches operate equally well with or without line tension.



KPF Type S-205 switches with inexpensive Quick-Break attachment on 60 kv rural transmission line. Switch shown in open position.



Basically different switch design proven in decades of service with leading utilities

Service-proved KPF switches look different because they *are* different.

Their simple, sturdy design insures freedom from mechanical failure or lubrication worries, and virtually eliminates maintenance. Self-aligning silver surfaced blades operate smoothly despite severe ice or crossarm warpage conditions. Installation is fast and economical—switches are bolted directly to crossarms on the ground or in the air. No separate strain insulators or extra crossarms are required; integral insulator stacks readily adjust to line sag.

KPF switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies throughout the world.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY

1624 East Alpine Avenue, Dept. E-1, Stockton 5, California

READ THIS AMAZING

Pin Type Insulator

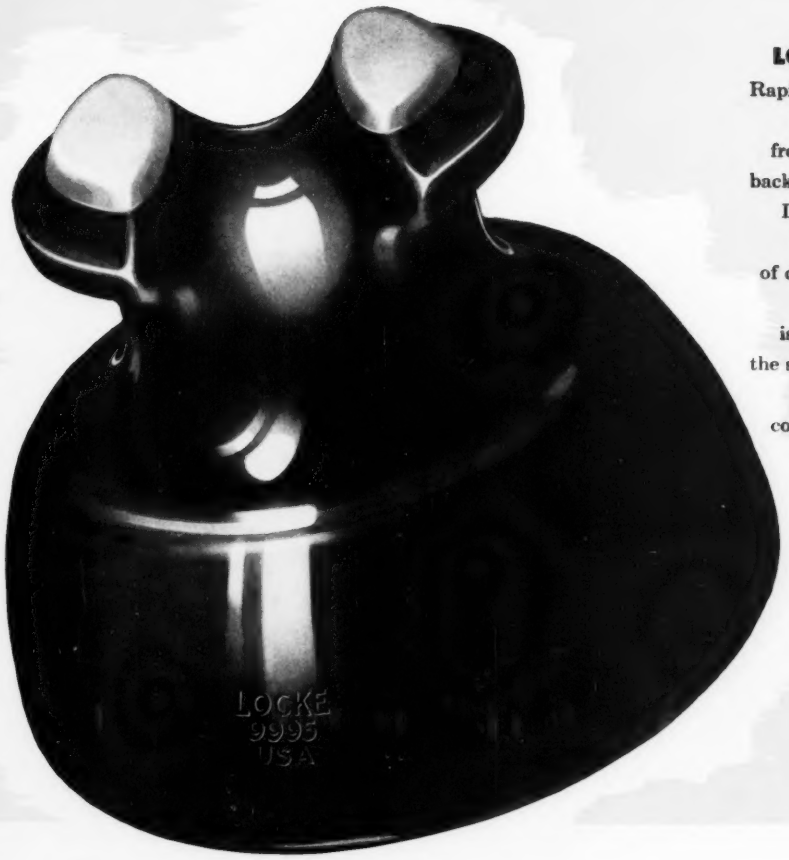
Service Record Report

from the

Henry Oestreich, Constr. Supt.
Black Hills Power and Light Company
Rapid City, South Dakota, says—

"Locke Pin Type Insulators so good we re-used them, even after 47 years continuous service ...at Rattlesnake Jack 'n Kickin' Horse gold mines!"

"Nobody knows how long they'll last", says Henry Oestreich, of Black Hills Power & Light Company, (at right), to Locke's Ed Moore as they inspect a 47 year old Locke Pin Type insulator at mouth of gold mine shaft near Deadwood, South Dakota. Henry has two ambitions . . . one, to maintain high standards of construction . . . the other, to lead his 28 man heavy construction line crew to a new safety record.



LOCKE'S ED MOORE reports from Rapid City, S. D., "In the Black Hills of South Dakota temperatures can zoom from 20° below zero to 60° above—and back again in 10 minutes! The ability of Locke Pin Types to withstand such thermal changes over a 47-year period of continuous, uninterrupted service reflects the supreme quality which is built into *all* Locke Insulators—from the smallest spool to the largest bushing. No wonder leading utilities place their confidence in Locke Insulators."

"You can't beat that for insulator performance," says Henry Oestreich, as he relates the facts of this amazing service record to Ed Moore.

Says Henry: "Back in 1905 my company put in lines to the Rattlesnake Jack'n Kickin' Horse gold mines.

"They're over in the Black Hills . . . right outside of Deadwood.

"That's the town where Jack McCall killed Wild Bill Hickok with a shot in the *back* of the head while Wild Bill was looking the other way . . . at his poker hand. And, it's where an old gal named Poker Alice took the boys real good at faro in the bar of the old Bodega cafe.

"Anyway, these lines to the Rattlesnake and Kickin' Horse stayed in continuous service 'til early last year when they were torn down.

"None of the material used to build those lines was of any value . . . except these Locke Pin Types which had been in continuous service since 1905. That's 47 years—the way I make it.

"They looked so good we checked 'em over, cleaned 'em up a little and decided to re-use 'em rather than junk 'em. So they're now in service again on the re-build of our Pluma-Nemo 12 kv line.

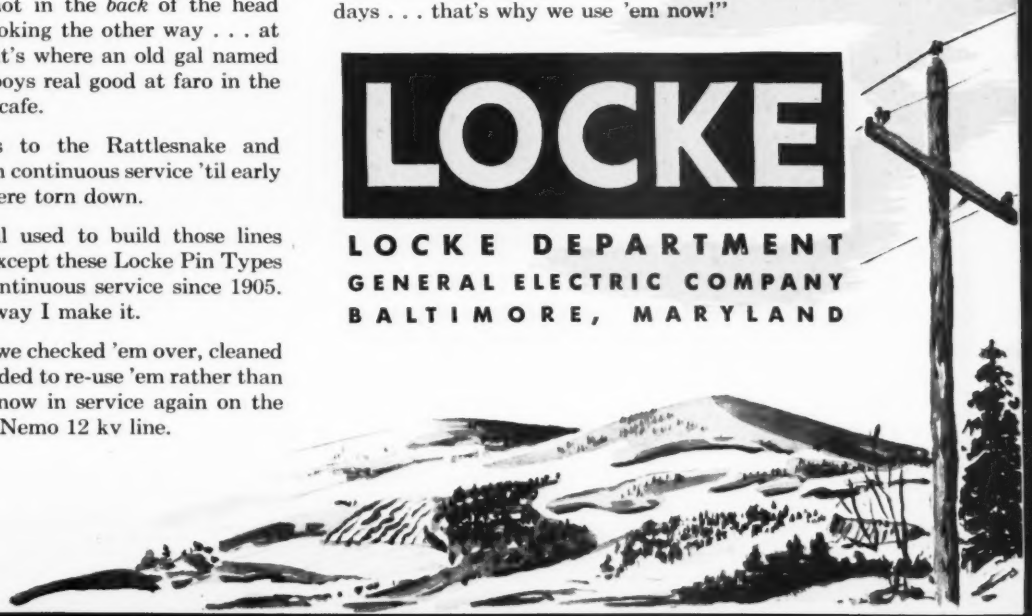
"But that's not the whole story. If you looked around our system you'd find a lot more of these old Locke Pin Types still in service on some of our company's original lines which are still in existence.

"You can't beat that for performance, can you?

"But it's the kind of performance we've got to have," says Henry, " 'cause during the winter it's tough to get through the snows up there in the Hills to maintain our lines. So, we've got to have nothing but the best construction all the way through. That's why we used good insulators **back in the old** days . . . that's why we use 'em **now!**"

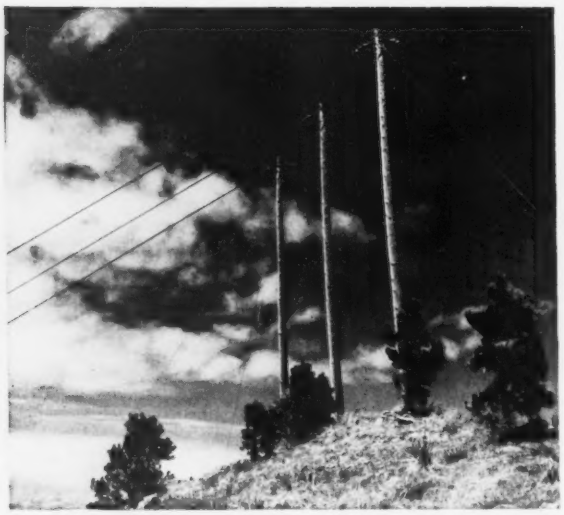
LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

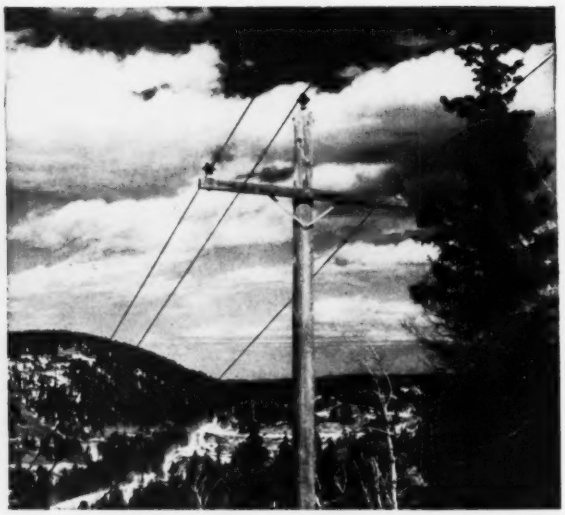


Typical Operating Conditions

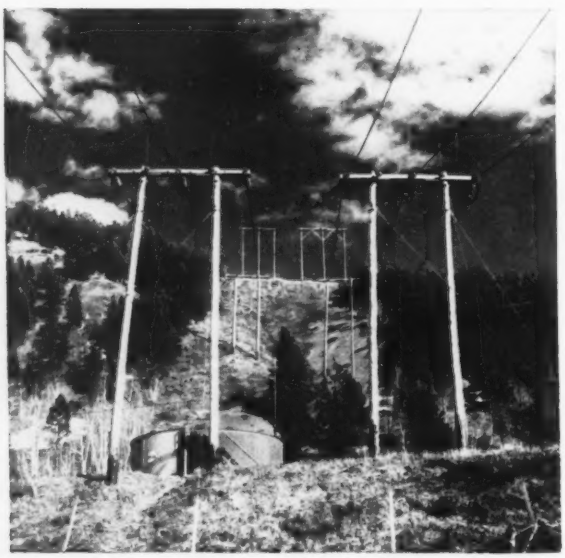
of Black Hills Power and Light Company, with headquarters in Rapid City, South Dakota



In mountain and prairie areas served by the Black Hills Power and Light Company, temperatures can drop from 60° above to 20° below zero . . . in ten minutes. Obviously, only the finest equipment can withstand such drastic thermal changes. Locke Pin Types have been doing just that for 47 years!



12 kv line stretching east from Terry Peak, famous ski resort 6,500 feet high in South Dakota's original hunting grounds of the Sioux Indians—the Black Hills. All three insulators in foreground are Locke Pin Types . . . put in service in 1905 . . . and still on the job!



69 kv line from company's Deadwood plant to Custer, South Dakota, 60 miles away, and to Osage, Wyoming, about 50 miles. Note combination of two-pole deadend, two-pole suspension and three-pole deadend. Many holes had to be dynamited seven feet into solid rock . . . a typical example of construction difficulties encountered in the Black Hills.

These are examples of the rugged terrain and tough climate under which Locke Pin Type Insulators established a 47 year record of continuous service—probably an all-time record!

No wonder leading utilities put their confidence in LOCKE Insulators.

Part of the 60-cell DME-17C Exide-Manchex installation at Texas Power & Light Company's Norwood Substation, Irving, Tex.

Switchyard of Norwood Substation. Switchgear operated by Exide-Manchex batteries.

AGAIN IT'S EXIDE AFTER 27 YEARS ON THE JOB

Exide-Manchex BATTERY

Long life is an outstanding Exide quality . . . proved by one utility after another. Again it is shown by the Exide life record at Texas Power & Light Company's Norwood Substation—27 years and 8 months of dependable service. Now the choice is another Exide, a greater-than-ever Exide, the new Exide-Manchex battery which assures:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COST: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" *Reg. T. M. U.S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

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FOR LARGE CONDUCTORS AND HIGH-STRENGTH STRANDS

**Light in weight—Holds full strength of conductor—
High in conductivity**

Completed NICOPRESS Splice on 4/0 Copper Conductor

**Completed NICOPRESS Splice on 3/8" Extra High Strength
Copperweld Strand**

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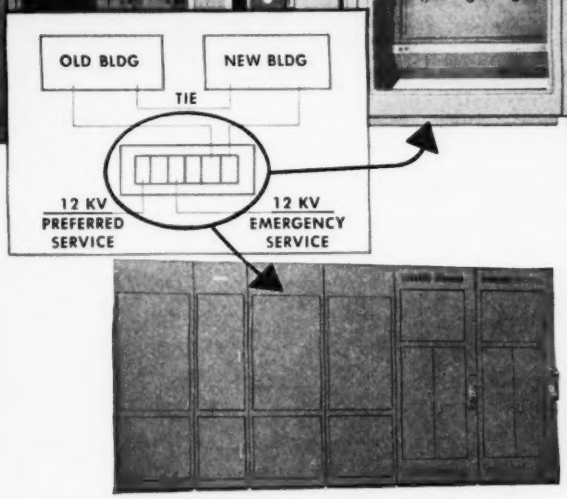

Switchgear at Lower Price Levels

S&C

METALCLAD SWITCHGEAR

reduces cost about half for switching centers

When a hospital recently undertook a modernization and expansion program, the enlightened use of this switchgear cut the cost of the switching center in half.

The 6-bay unit was installed to provide preferred and emergency sources of 12,000-volt power (with automatic throwover and return), and metering, plus switching and protection of the outgoing feeders to the load centers in each of two buildings. Secondary circuits are 220-volt 3-phase power, and 120/240 lighting.

The program also involved changing the supply voltage from 4 KV to 12 KV for greater over-all economy.

Scores of installations in a wide variety of industrial plants, public and commercial buildings have demonstrated beyond question that S&C reliability and performance cannot be surpassed . . . and you pay substantially less.

●

If you are planning a new installation, or have the job of modernizing an old one, don't let specifications leave the drawing board without first finding out how S&C Metalclad Switchgear can save you money.

Nearly always it affords the lowest cost way to a thoroughly reliable switching center or service entrance unit. Write for full information today.

S&C ELECTRIC COMPANY

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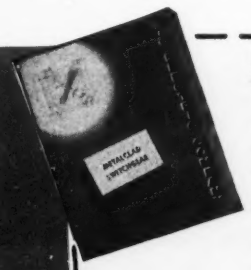
SPECIALISTS IN HIGH-VOLTAGE CIRCUIT INTERRUPTION



S&C Electric Company
4421 Ravenswood Ave., Chicago 40, Illinois

Please send me your new booklet on S&C Metalclad Switchgear. No obligation on my part, of course.

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Company_____

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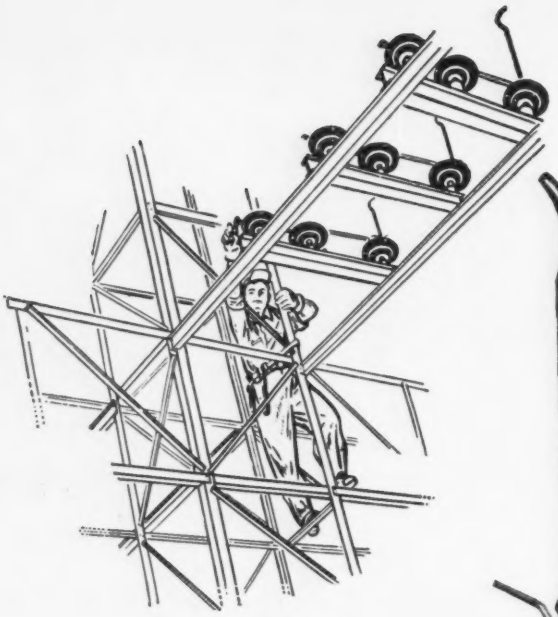

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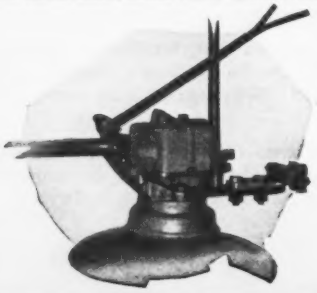
200 TO 3000 AMPERES

7500 TO 287,000 VOLTS



EXCLUSIVE CONTACT HOUSING

Protects contacts against sleet, dirt and arcing. Also acts as an ice breaker.

HI-VOLTAGE

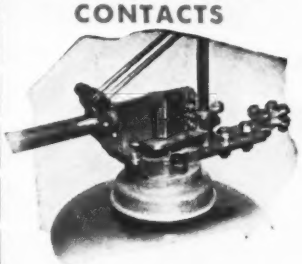
Hi-Voltage installation savings

No wonder. Only Hi-Voltage reduces switch installation cost from 20 to 40 percent.

Fine engineering is the reason. Every part is designed just right, and Hi-Voltage takes time to assemble and to completely test each switch before shipment. When your crews start assembly, they find all parts clearly identified and keyed to easy-to-follow installation instructions. There's no field cutting or drilling. We've even made your final adjustments.

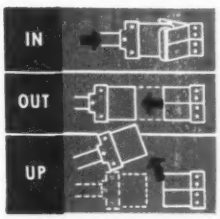
Your Joslyn Salesman will tell you more about installation savings and other exclusive advantages of Hi-Voltage Switches. Ask him or write Hi-Voltage Equipment Company, 4000 East 116th Street, Cleveland 5, Ohio.

SILVER-NICKEL CONTACTS

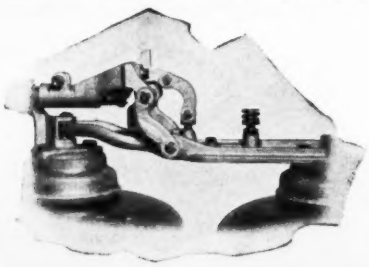


Combine low resistance with low friction. Stainless steel springs maintain maximum conductivity.

IN-OUT SWITCH ACTION



Straight-line motion of the switch-arm provides positive opening and closing of the switch. No twisting or turning.



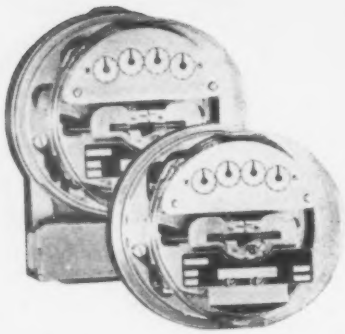
OPERATING MECHANISM

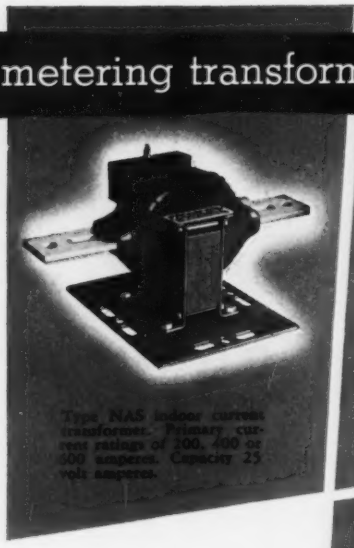
A direct mechanical linkage. Uses no cams or rollers to deliver smooth powerful action. There is nothing to stick, bind or adjust.

EQUIPMENT COMPANY

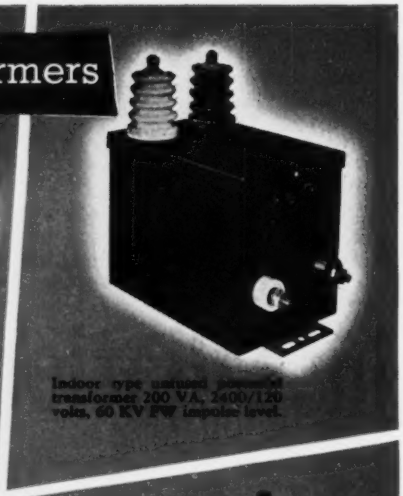
4000 EAST 116TH STREET · CLEVELAND 5, OHIO

current, potential and metering transformers

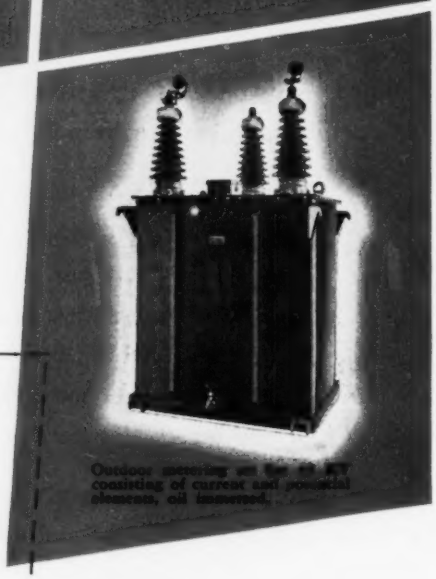




Type NAS indoor current transformer. Primary current ratings of 200, 400 or 600 amperes. Capacity 25 volt amperes.



Indoor type unitized potential transformer 200 V.A. 2400/120 volts, 60 KV BIL impulse level.



Outdoor metering set for 69 KV consisting of current and potential elements, oil immersed.

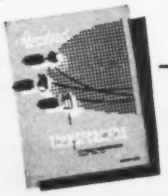
When accuracy is a factor

In the field of measurement for precision metering, operation of indicating instruments, relays and control apparatus, there is no substitute for accuracy.

The Standard Transformer Company has designed and is manufacturing a complete line of accurate current and potential transformers for every application... current, potential and metering transformers for any voltage up to and including 72 KV, and at any specified frequency. All thermal and mechanical ratings in accordance with industry's requirements and standards for each specific use. All standards set by ASA and EEI-NEMA in respect to accuracy are met.

Many prominent manufacturers of switchgear and control apparatus are regular users of STANDARD current and potential transformers. Our production facilities are flexible and engineering skill versatile enough to produce quickly transformers of special design to meet your specifications. Call in your STANDARD representative for further information.

everything points to



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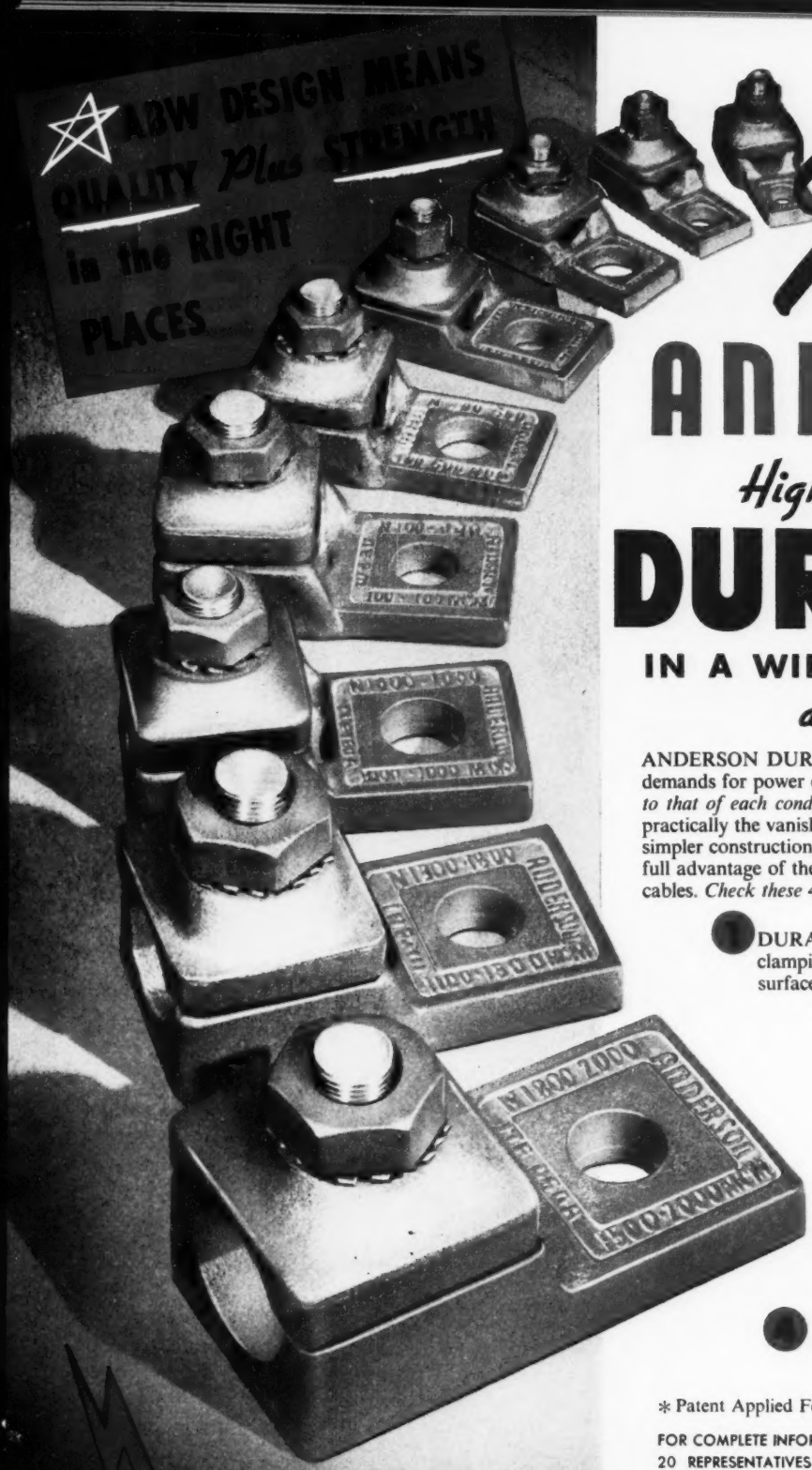

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IN A WIDER RANGE OF SIZES *and capacities*

ANDERSON DURA LUGS* are specifically designed to meet the demands for power connectors with current-carrying capacities *equal to that of each conductor used.* Joint resistance has been reduced to practically the vanishing point . . . and, their sturdier, more compact, simpler construction all combine to assure positive pressure and take full advantage of the current-carrying capacity of every strand in the cables. *Check these 4 points of superiority:*

- DURA LUG* design combines high tensile bronze for clamping members and high conductivity metal contact surfaces for greater current carrying characteristics.
  This means:
  - **A** Minimum elongation in the cable opening to maintain clamping pressure.
  - **B** Withstands A.S.T.M. Mercurous Nitrate Test.
  - **C** Develops maximum "pull out."
- They require no special tools to install.
- Lockwasher provided to prevent loosening under vibration.
- 11 sizes provide the *right* capacity for each size of cable used.

* Patent Applied For

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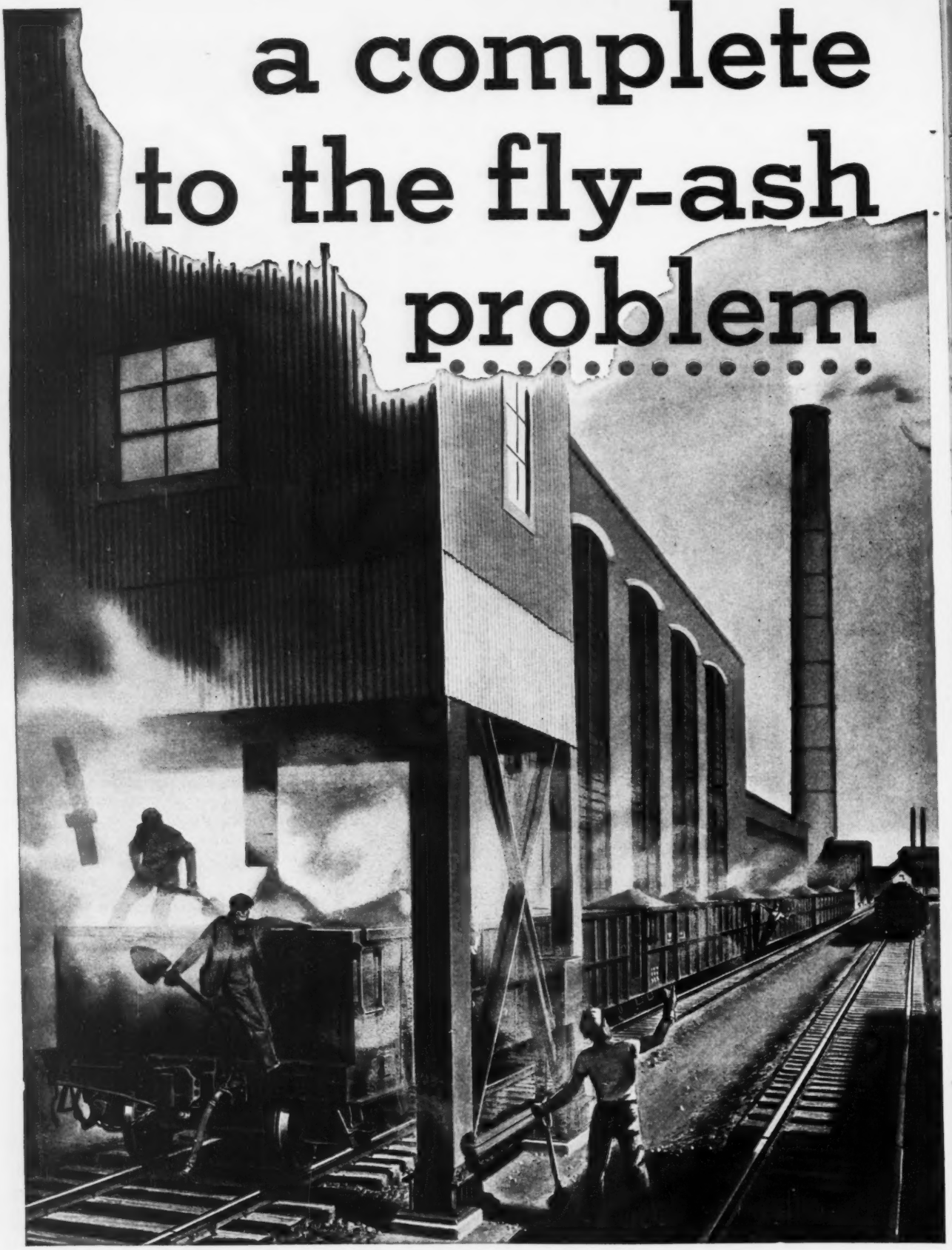
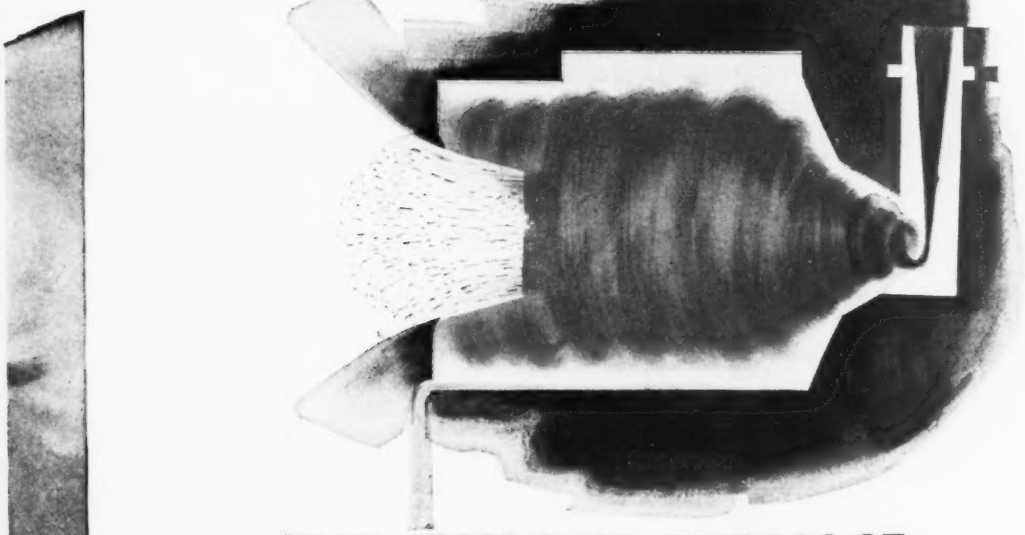
a complete to the fly-ash problem



solution



THE CYCLONE FURNACE

Power-plant operators have been plagued for years by the expense and nuisance caused by fly ash and the community relations problems involved in its disposal. They have spent millions to keep fly-ash from reaching the atmosphere and, yearly, spend many additional millions in handling thousands of tons of troublesome, dusty fly-ash and paying for its removal.

Today, the Cyclone Furnace completely solves this major problem:

1. Most of the ash produced by burning the coal is changed to molten slag in the Cyclone Furnace. This slag is easy to handle, has many uses, and often can be sold, representing an asset rather than a liability. Because there is so little ash in the gas leaving a Cyclone-Furnace-fired boiler, it is often possible to eliminate precipitators. Where precipitators are used, they can be greatly simplified, because the designer can think in terms of pounds—instead of tons—of ash per hour.

2. Where local conditions may require use of precipitators in conjunction with the Cyclone Furnace, there is no need for handling the fly-ash collected. It can, with simple equipment, be blown back into the Cyclone Furnace to be melted down into slag.

Through this one feature alone—by completely solving the fly ash problem—the Cyclone Furnace greatly improves plant operations. But many other advantages, such as increased availability through elimination of outage-causing equipment, simplified operation through use of crushed coal, reduced cost of upkeep, and higher thermal efficiency, also are obtained with Cyclone Furnaces.

Many B&W Cyclone-Furnace-fired boilers are in operation, in various parts of the country, burning many different kinds of coal. The operating requirements and the design conditions for these boilers include most of the variations that can be expected in utility practice. We will be pleased to discuss with you the many ways in which Cyclone Furnace firing can be of benefit to you.

CYCLONE FURNACE BOILER UNITS IN OPERATION

Owner & Station	Number of Boilers	Kilowatt Rating
COMMONWEALTH EDISON		
Calumet	1	18,000
Fisk	2	150,000
Ridgeland	4	300,000
PUBLIC SERVICE CO. OF NORTHERN ILLINOIS		
Waukegan	1	40,000
Waukegan	1	110,000
Joliet	2	107,000
NORTHERN INDIANA PUBLIC SERVICE CO.		
Michigan City	3	105,000
DOW CHEMICAL CO.		
West Side Plant	1	30,000
South Side Plant	2	60,000
WISCONSIN POWER & LIGHT		
Sheboygan	1	60,000
BABCOCK & WILCOX		
Barberton	1	—
JERSEY CENTRAL POWER & LIGHT		
South Amboy	1	62,500
TOTAL UNITS IN OPERATION	20	1,042,500

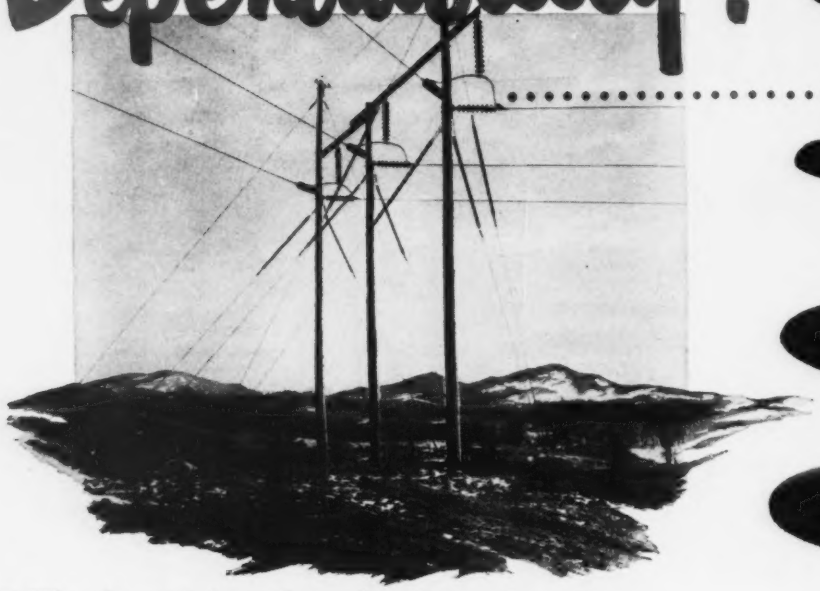
BABCOCK & WILCOX

BOILER DIVISION

G-610

For the Rugged hill country of West Virginia . . .

Rugged Dependability!



When the terrain is rough . . and weather tough . . a power transmission line must be *built to last.* Breakdowns must be avoided . . especially during the winter months when mile after mile of the line is virtually inaccessible.

Under conditions like these, expert "know-how" must be coupled with the finest equipment to assure positive dependability at all times . . and the line pictured here in the rugged hill country of West Virginia is an outstanding example of power transmission engineering.

Porcelain Products Suspension Insulators were chosen for this installation . . . a product of proven performance on thousands of miles of power lines.

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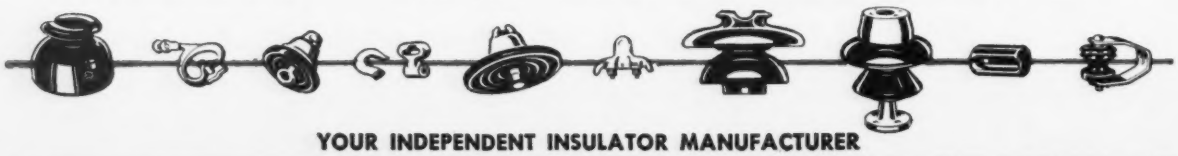

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PARKERSBURG, W. VA.

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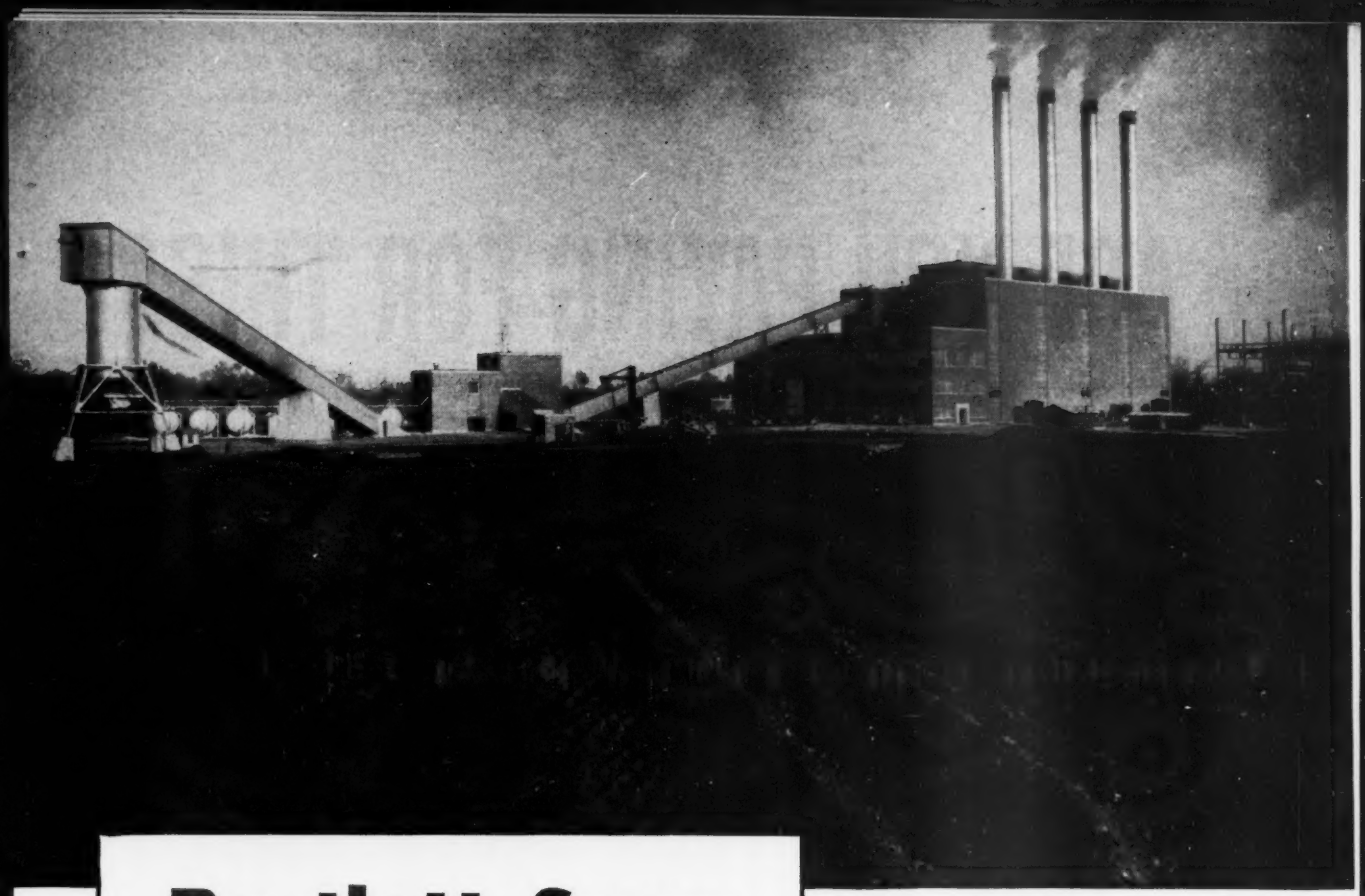
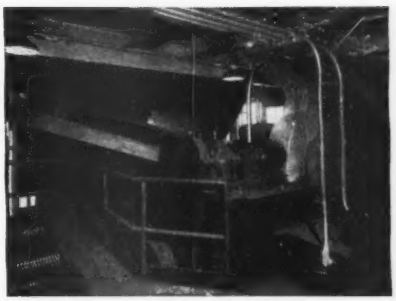


General View of Meredosia Power Station
Central Illinois Public Service Co.
Sargent and Lundy
Consulting Engineers

Bartlett-Snow coal handling at *Meredosia*

● The illustration above shows the first 100,000 KW unit of a plant which is to be extended into a 200,000 KW station. All coal handling equipment including the receiving and reclaiming hoppers and grillage, duplex feeder, conveyors, galleries, breaker screen and all supporting structures were fabricated in our shops, and installed by us, to Sargent and Lundy's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities, work with you on your next job.

Belt Conveyor in Tunnel
Handling Coal from Track Hopper



Drive for Collector Belt Under Breaker
the Refuse Belt and Automatic Sampler

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"Builders of Equipment for People You Know"

ARE YOU PAYING FOR THIS?

AND GETTING ONLY THIS?

THE SAME money you pay for about 7 inches of copper weatherproof wire will buy *12 inches* of Kaiser Aluminum weatherproof wire! Here's what this means in dollars:

$46.27 will buy 1000 feet of #6 copper. But only $27.05 will buy 1000 feet of #4 Kaiser Aluminum neoprene or polyethylene covered wire.*

That's a saving of $19.22 per 1000 feet in material costs alone!

You are certain of big material savings with *any* type of Kaiser Aluminum weatherproof wire. What's more, the use of Kaiser Aluminum provides *additional* savings in handling, construction and maintenance costs.

These big savings, plus proved efficiency under the most rugged conditions, is the reason for the rapidly growing use of aluminum weatherproof for distribution and service lines. (Almost 90% of all transmission lines are now being built with aluminum wire.)

We have paced this growth with the development of major production facilities. Today, we are the nation's largest producer of weatherproof and insulated aluminum wire and cable.

Let us furnish you with complete information on the large economies possible with aluminum conductor. We'll give prompt attention to your request. Call or write any of our distributors or Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Kaiser Aluminum

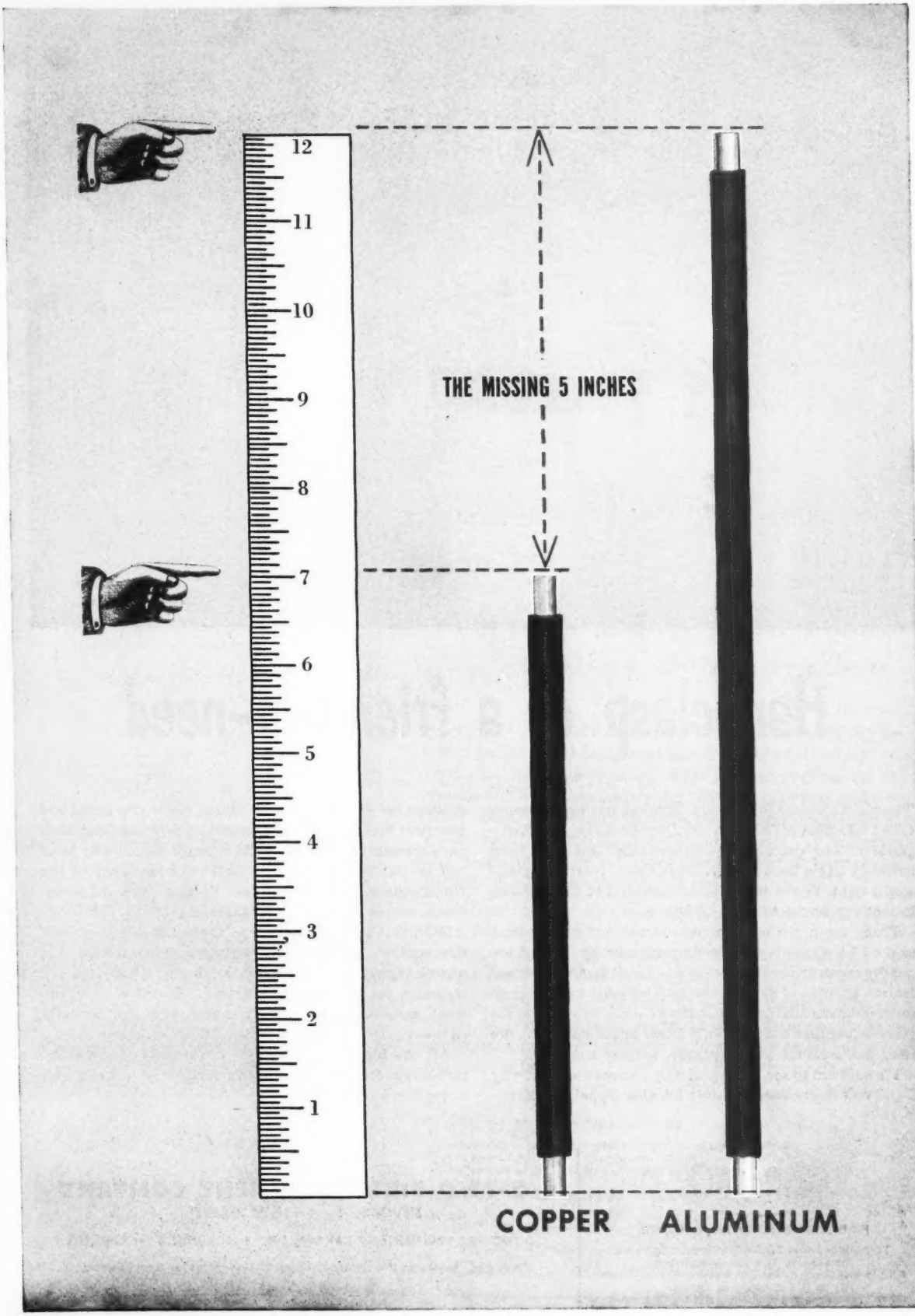
Setting the pace—in growth, quality and service

*Based on August, 1953 prices.

KAISER ALUMINUM ELECTRICAL CONDUCTOR DISTRIBUTORS

Line Material Company
General Electric Supply Company
Westinghouse Electric Supply Co.

Capital Electric Supply
Central Electric Supply Company, Inc.
Champion, Inc.
City Electric Distributors, Inc.
Crescent Electric Supply Company
Dauphin Electrical Supplies Company
Dutton-Lainson Company
Electrical & Mechanical Supply Corp.
Eoff Electric Company
Florida Electric Supply, Inc.
George H. Wahn Company
Hampden Electric Supply Co.
Hunzicker Brothers
Interstate Electric Co. of Shreveport, Inc.
Maydwell & Hartzell, Inc.
Mine & Smelter Supply Company
Nelson Electric Supply Company
Price Electric Company
Russell Beldon Electric Company
S. M. Supply Co., Inc.
Southern Minnesota Supply Company
Stuart C. Irby Company
Stubbs Electric Company
Tafel Electric & Supply Company
The Korsmeyer Company
Virginian Electric, Inc.


12
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THE MISSING 5 INCHES
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There's confidence in the very "feel" of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers. The quick-acting "Squeez-Grip" fits your hand naturally like a handclasp ... hangs right ... carries right ... works right. You're in complete command of the situation instantly ... no fumbling ... no fatigue.

From the non-conducting, shatterproof discharge horn to the high strength, durably finished cylinder, you get top quality construction that results in a lifetime of satisfactory service. Because of the very few working parts and corrosion resistant materials throughout, the total cost to you over the years is less than other initially lower priced makes ... fire after fire, recharge after recharge, without trouble.

It's not hard to see, when you fully compare and try, why C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers are your best buy for killing flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. Sizes range all the way from 2½ to 100 pounds capacity ... all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus.

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting, inert gas ... smothers fire instantly, leaves no after fire mess ... harmless to equipment, materials and finishes ... even food is still perfectly edible.

Act now for complete free information on these first-rate, sure-acting fire extinguishers. Remember fire doesn't wait ... get the facts today!

C-O-TWO

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...OR DIRECT IN EARTH

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Every day, more and more electrical engineers specify neoprene-jacketed cable for underground distribution systems. In ducts, neoprene-jacketed cable is ideal because its light weight and flexibility assure simplified installation and lower labor costs. Tough and durable, neoprene stands up under rough handling around manholes and ducts . . . withstands the effects of lubricants. Even grease and oils that may be present in old ducts present no problem.

Buried directly in the ground, neoprene resists attack from soil acids and stands up under crushing from settling earth. Unlike metallic coverings, it is not damaged by electrolytic action caused by stray currents.

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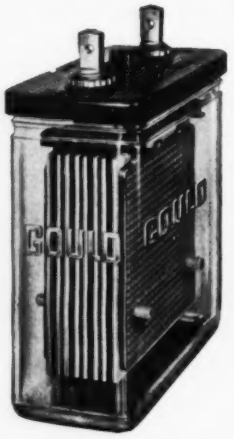

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THE IMPORTANT 1953 CODE CHANGES

COVERING WIRE CABLE AND CONDUIT

ARTICLE 310—CONDUCTORS • SECTION 3102—CONDUCTOR INSULATIONS

TRADE NAME	TYPE LETTER Changes are in **BOLD**	Max. Operating Temp.	SPECIAL PROVISIONS
Rubber-Covered Fixture Wire Solid or 7 Strand	**RF-1**	60C 140F	Fixture wiring. Limited to 300 V.
	RF-2	60C 140F	Fixture wiring and as permitted in section 3103.
Rubber-Covered Fixture Wire Flexible Stranding	**FF-1**	60C 140F	Fixture wiring. Limited to 300 V.
	FF-2	60C 140F	Fixture wiring and as permitted in section 3103.
Heat-Resistant Rubber Covered Fixture Wire Solid or 7 Strand	**RFH-1**	75C 167F	Fixture wiring limited to 300 V.
	RFH-2	75C 167F	Fixture wiring and as permitted in section 3103.
Heat-Resistant Rubber-Covered Fixture Wire Flexible Stranding	**FFH-1**	75C 167F	Fixture wiring Limited to 300 V.
	FFH-2	75C 167F	Fixture wiring and as permitted in section 3103.
Thermoplastic-Covered Fixture Wire—Solid or Stranded	TF	60C 140F	Fixture wiring and as permitted in section 3103.
Thermoplastic-Covered Fixture Wire—Flexible Stranding	TFF	60C 140F	Fixture wiring.
Cotton-Covered Heat-Resistant, Fixture Wire	CF	90C 194F	Fixture wiring. Limited to 300 V.
Asbestos-Covered Heat-Resistant, Fixture Wire	AF	150C 302F	Fixture wiring. Limited to 300 V.
Code Rubber	R	60C 140F	General use.
Heat-Resistant Rubber	RH	75C 167F	General use.
Moisture-Resistant Rubber	RW	60C 140F	General use and wet locations.
Moisture and Heat-Resistant Rubber	**RH-RW**	60C 140F 75C 167F	General use and wet locations. General use.
Moisture and Heat-Resistant Rubber	**RHW**	75C 167F	General use and wet locations.
Latex Rubber	RU	60C 140F	General use.
Heat-Resistant Latex Rubber	**RUH**	75C	General use.
Moisture-Resistant Latex Rubber	RUW	60C 140F	General use and wet locations.
Thermoplastic	T	60C 140F	General use.
Moisture-Resistant Thermoplastic	TW	60C 140F	General use and wet locations.
Mineral Insulation (Metal Sheathed)	**MI**	85C 185F	General use and wet locations with Type 0 termination fittings. Maximum operating temperature for special applications 250C.
Thermoplastic and Asbestos	TA	90C 194F	Switchboard wiring only.

TRADE NAME	TYPE LETTER Changes are in **BOLD**	Max. Operating Temp.	SPECIAL PROVISIONS
Varnished Cambric	V	85C 185F	Dry locations only. Smaller than No. 6 by special permission.
Asbestos and Varnished Cambric	AVA	110C 230F	Dry locations only.
Asbestos and Varnished Cambric	AVL	110C 230F	Wet locations.
Asbestos and Varnished Cambric	AVB	90C 194F	Dry locations only.
Asbestos	A	200C 392F	Dry locations only. Not for general use. In raceways, only for leads to or within apparatus. Limited to 300 V.
Asbestos	AA	200C 392F	Dry locations only. Open wiring. Not for general use. In raceways, only for leads to or within apparatus. Limited to 300 V.
Asbestos	AI	125C 257F	Dry locations only. Not for general use. In raceways, only for leads to or within apparatus. Limited to 300 V.
Asbestos	AIA	125C 257F	Dry locations only. Open wiring. Not for general use. In raceways, only for leads to or within apparatus.
Paper		85C 185F	For underground service conductors, or by special permission.
Slow-Burning	SB	90C 194F	Dry locations only. Open wiring; and in raceways where temperatures will exceed those permitted for rubber-covered or varnished cambric-covered conductors.
Slow-Burning Weatherproof	SBW	90C 194F	Dry locations only. Open wiring only.
Weatherproof	WP	80C 176F	Open wiring by special permission where other insulations are not suitable for existing conditions.

NOTE: The significance of the above changes is as follows:

1. The addition of four new designs of fixture wire — **RFH-1, RFH-2, FFH-1, FFH-2,** all of which have a maximum operating temperature of 75C. These new designs narrow the gap which now exists between the 60C fixture wire and the 90C heat resisting fixture wire. Several applications are open for the use of these new 75C insulations.

2. The old Type letter designations, RF64 and RF32 as well as FF64 and FF32 have been replaced as shown.

3. The old Type letter designations, RUF and RUFF have been deleted. They are now covered under the general designations for rubber insulation.

4. A new Type letter, **RUH,** heat resistant latex rubber, has been added.

5. Two more new Types, **RH-RW** and **RHW** have been added. Type **RH-RW** is a combination heat and moisture resistant insulation recognized for use in a wet location, at a maximum operating temperature of 60C, 140F. It is also recognized for general use at 75C–167F. This means that a #1 Type **RH-RW** insulated conductor would have a current carrying capacity of 110 amperes when used in a wet location and 130 amperes when used generally. This is covered by a new note, 4a, following Tables 1 and 2, Chapter 10.

Type **RHW** is a 75C insulation and will therefore have a current carrying capacity as shown in column 3 of Tables 1 and 2, Chapter 10, irrespective of use in a wet location or general use.

For a larger version of this Chart, write Triangle Conduit & Cable Co., New Brunswick, New Jersey.

The Trade Mark of TOP Quality

TRIANGLE

PLEASE TURN THE PAGE →

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

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ADDITIONAL REVISIONS IN THE NATIONAL ELECTRICAL CODE WHICH PARTICULARLY CONCERN CONDUCTORS, CABLE ASSEMBLIES AND CONDUIT OR TUBING

SECTION 2112. COLOR CODE. BRANCH CIRCUITS. Add a new paragraph as follows: "Any conductor intended solely for grounding purposes shall be identified by a green color unless it be bare. Conductors having a green covering shall not be used for other than grounding purposes."

SECTION 2203 a. GENERAL LIGHTING. SCHOOL BUILDINGS. Table B which covers the demand factors for various types of occupancy has been changed to eliminate any demand factor in a school building. The total wattage, 100% demand, must be used in figuring such feeders.

COMMENT: The Panel feels that present day illumination practices and loading demands in a school occupancy do not justify less than 100% of the unit loads in Column A.

SECTION 2203 a. GENERAL. Under the Table a change has been made for Office Buildings. At the present time such occupancies have a unit load per sq. ft. of 2 watts. This has been increased to 3 watts. The 20,000 watt load now subject to a 100% demand factor has been increased to 30,000 watts.

COMMENT: The Panel feels that the increased levels of illumination, air conditioning, etc., in modern construction justify this increase in feeder sizes.

SECTION 2303 a. UNINSULATED NEUTRAL. This section has been changed to read as follows:

"In the case of Service Conductors that have a nominal voltage to ground of not more than 300 volts, a grounded service conductor without an insulating covering may be installed."

COMMENT: The Panel is of the opinion that the change will encourage more "inter-connected grounding" which will improve protection.

SECTION 2311. MECHANICAL PROTECTION (UNDERGROUND SERVICES). The new provision reads as follows:

"Underground service conductors shall be protected against mechanical injury by being installed in duct, conduit, in cable of one or more conductors approved for the purpose, or by other approved means. See Section 3102 b."

COMMENT: It is now clear that a one conductor assembly is considered a cable.

SECTION 2574. VOLTAGES. BONDING. EXCEEDING 250 VOLTS. THIS WILL BE RENUMBERED SECTION 2575. This Section has been reworded so that service entrance conductors are eliminated and the voltage is changed from 150 to 250 volts.

COMMENTS: The principal reason for the change concerns the three phase, 4 wire-delta connection which results in 240 volt, 3 phase current for power and single phase 120-240 volt current for lighting. The highest voltage to ground on such a combination is 208 volts on one phase wire only; the other two phases operate at 120 volts to ground. While the original objective was to increase the voltage only to 208 volts and thus clear up the confusion which has arisen on 3 phase, 4 wire delta systems, the Panel members have decided to raise the voltage to 250 volts.

SECTION 2592 b. INSTALLATION. (GROUNDING CONDUCTORS) This is a new provision which reads as follows:

"2592 b CONDUCTOR ENCLOSURES AND EQUIPMENT ONLY. A grounding conductor for conductor enclosures and equipment only shall meet the requirements of Section 2592 a, except that where smaller than No. 6, as permitted by Section 2595, it need not be armored or installed in a raceway if run through the hollow spaces of a wall or partition or otherwise run so as to be not subject to mechanical injury."

COMMENT: The continued promotion of the use of grounding conductors in cable assemblies should minimize the use of alternate methods of grounding enclosures and equipment.

SECTION 3018. ALTERNATING CURRENT SYSTEMS IN METAL ENCLOSURES. Change last sentence of this section to read as follows:

"If the capacity of a circuit is such that it is impracticable to run all conductors in one enclosure, the circuit may be divided and two or more enclosures may be used providing each phase conductor of the circuit and the neutral conductor, if one is used, are installed in each enclosure. The conductors of such an installation can conform to the provisions of Sections 3105 for multiple conductors."

SECTION 3105. CONDUCTORS IN MULTIPLE.

"Conductors in sizes 1/0 to 500,000 c.m., inclusive, may be run in multiple provided they are of the same length and have the same circular mil area and type of insulation. When conductors are run in multiple, they shall be arranged and terminate at both ends in such a manner as to insure equal division of the total current between all conductors that are involved."

COMMENT: The second and third sentences of the present text have been deleted. They read as follows: "Not more than three No. 1/0, four No. 2/0, nor five Nos. 3/0 to 500,000 c.m. conductors, may be run in multiple. Except as herein provided, conductors shall be run in multiple only by special permission or as permitted in Section 6205."

It is common practice to use as many conductors as may be necessary and experience has not yet indicated the necessity for limitations in numbers now imposed.

ARTICLE 334 — ARMORED CABLE

SECTION 3342. USE. The present provisions under Section 3342 indicate that Type ACV cable is limited in size to No. 4 and larger. The new wording makes an exception when ACV cables are approved for use at over 600 volts. No minimum wire size is specified.

The fourth sentence has been changed. The new provision recognizes Armored Cable for use in the air voids of any type of masonry block if they are not below grade line and otherwise not exposed to excessive moisture or dampness.

ARTICLE 330. NON-METALLIC SHEATHED CABLE.

SECTION 3362. USE. This Section has been rewritten to provide for two types of cable as follows:

a.—Type NM—This type of cable is suitable for use for general wiring in normally dry locations and in the hollow spaces of masonry walls where not subject to excessive moisture or dampness.

b.—Type NMC—We now have special recognition and extended use for the thermoplastic and neoprene jacketed cables which are considered suitable for use in corrosive locations and dry, moist or damp locations, including inside and exterior masonry block walls, above or below grade line, where excessive moisture may occur periodically. This type of cable is not permitted in wet locations as defined in Article 100, however, it is not intended to prohibit the use of the new type UF cable covered by Article 339, when used for interior wiring under Article 336, in such wet locations. Type NMC cable may be embedded in plaster or run in a shallow chase in masonry walls and covered with plaster within 2 inches of the finished surface provided it is protected against damage from nails by a cover of corrosion-resistant coated steel at least 1/16 inch in thickness and 3/4 inch wide in the chase or under the final surface above or below grade lines.

c. — USES NOT PERMISSIBLE FOR EITHER TYPE NM OR NMC NON-METALLIC SHEATHED CABLE. These types shall not be used as (1) Service-entrance cable, (2) in commercial garages, (3) in theatres except as provided in Section 5211, (4) in motion picture studios, (5) in storage battery rooms, (6) in hoistways, (7) in any hazardous location, (8) embedded in poured cement, concrete or aggregate.

ARTICLE 339. UNDERGROUND FEEDER AND BRANCH CIRCUIT CABLE TYPE UF.

3391. SCOPE. Installations of underground feeder and branch circuit cable (Type UF) shall comply with the provisions of Section 3001 and 3020 inclusive, paragraph b of Section 3102, and in addition shall conform with provisions of Section 3392.

3392. USE. Underground feeder and branch circuit cable may be used underground, including direct burial in the earth, as feeder or branch circuit cable when provided with overcurrent protection not in excess of the rated current carrying capacity of the individual conductors. If single conductor cables are installed, all cables of the feeder circuit, sub-feeder circuit or branch circuit, including the neutral conductor, if any, shall be run together in the same trench or raceway. If buried directly in the earth, supplementary mechanical protection, such as a covering board, concrete pad, raceway, etc., when considered necessary, may be required by the authority enforcing the Code. Multiple Conductor, Type UF cable may also be used for interior wiring when complying with the provisions of Article 336 and may be used in wet locations.

COMMENT: This is a new Code Article which extends the recognition of the use of cables for direct burial in the ground from that now recognized for service use, Type USE, to Type UF. (feeders and branch circuits only)

ARTICLE 346 — RIGID METAL CONDUIT

ARTICLE 348 — ELECTRICAL METALLIC TUBING

SECTION 3464. WET LOCATIONS. A new paragraph has been added which reads as follows: "All supports, bolts, straps, screws, etc., shall be of corrosive-resistant materials or protected against corrosion by approved corrosion-resistant materials."

The same provision also applies to Electrical Metallic Tubing used in wet locations. (Section 3484)

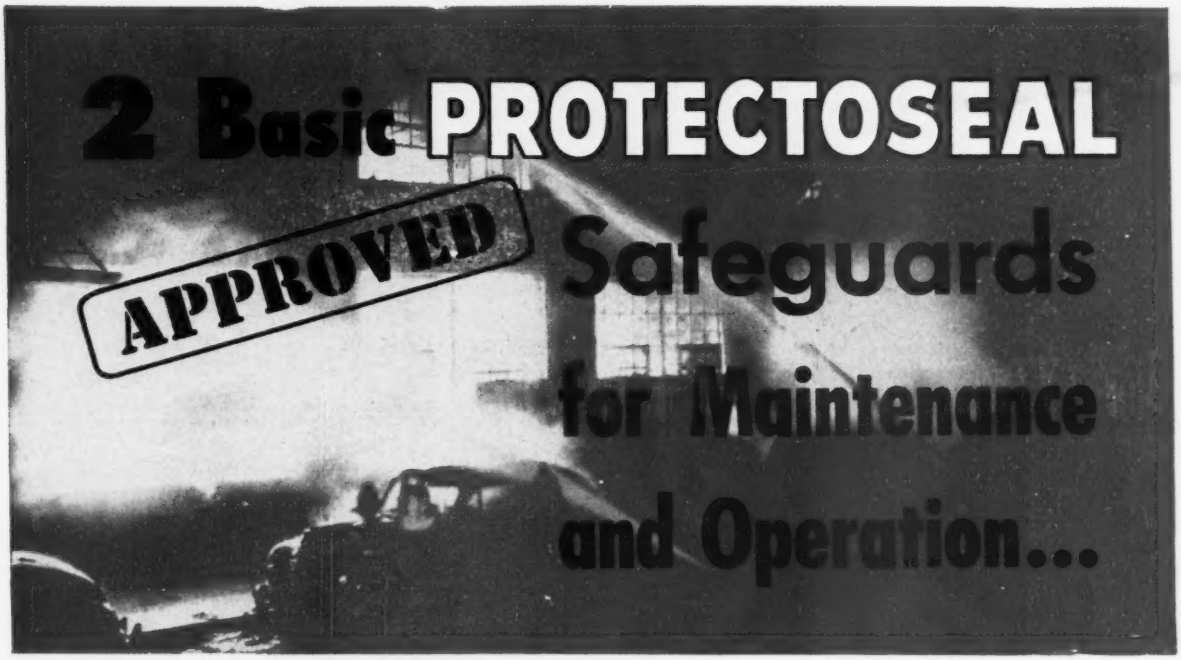
The Trade Mark of TOP Quality

TRIANGLE

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

PRESENTED AS A PUBLIC SERVICE. TO THE BEST OF OUR KNOWLEDGE THIS INFORMATION IS ACCURATE BUT TRIANGLE ASSUMES NO RESPONSIBILITY.



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SAFETY CANS

For general use wherever flammables are employed at any point within the plant. Have electrically seamwelded, sturdy bodies reinforced by beading. Fire baffle is a double concentric cylinder inside the base of the spout. Spring-loaded cap is mounted on a ball and socket joint to automatically make a tight, complete closure. Squeeze-grip handle is wide, oval, roomy. Ease and positive control while pouring.

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OILY WASTE CANS

A necessity in every shop or plant for the safe placement of oily or solvent-soaked rags, cleaning swabs and other waste shop material; required by many insurance companies. Permanently closed can is of sturdy seam-welded construction. Full length cover hinge for permanent alignment. Opens wide by slight foot pressure at any point on full-width treadle for easy use.

Approved by Underwriter's Laboratories, Inc., and Associated Factory Mutual Fire Insurance Companies

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For more than a quarter-century The Protectoseal Company has devoted its entire research and engineering organization and its modern manufacturing facilities exclusively to the production of a complete line of containers and devices for the safe control and handling of flammable liquids.

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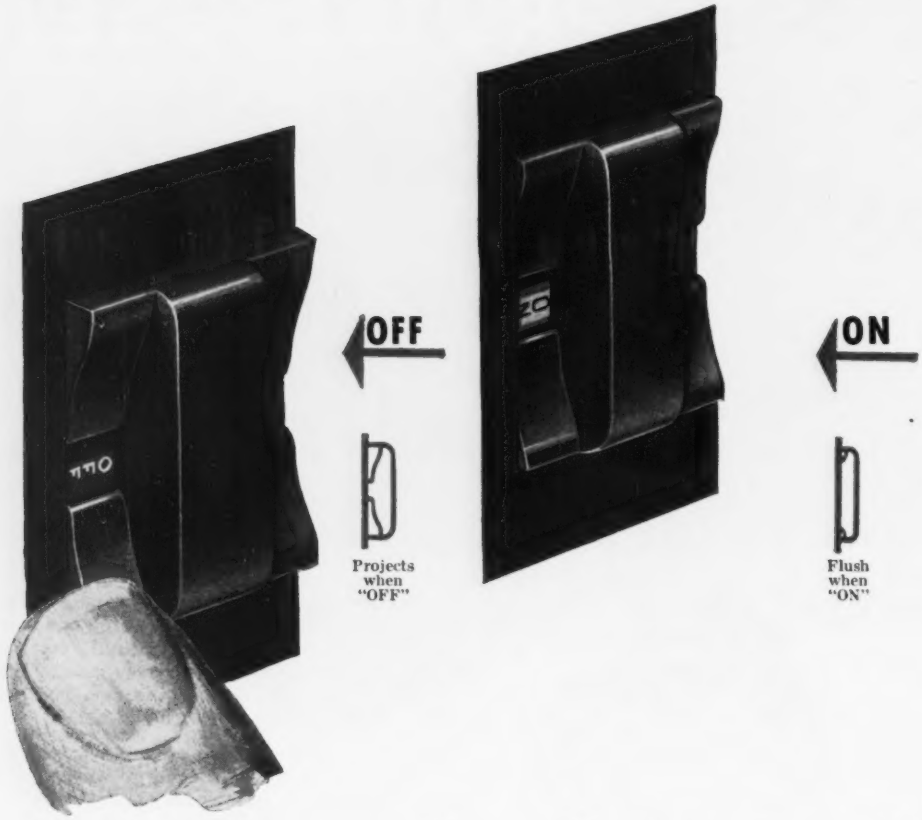
BULLDOG *Pushmatic* ELECTRI-CENTER



Lets your finger "see" the trouble

Nothing so dramatically points up the trouble-free simplicity and safety of the BullDog Pushmatic Electri-Center as the features illustrated above.

When a circuit is overloaded, and the Pushmatic automatically clicks "OFF"—the "OFF" button projects beyond the "ON" buttons. This means that the button reading "OFF" can be easily located by *touch*—even in the dark.

When the trouble has been corrected, you simply push the button, it clicks to "ON"—and current is restored. With a BullDog Pushmatic Electri-Center installed, service calls to reset breakers or to replace fuses, *end*. Designed for today's "Appliance-Age" homes, modern Electri-Centers of thoroughbred quality, provide spare circuits to cover all future needs. They are available from 2 to 42 circuits.

Write today for free bulletin PM-355, giving complete details on Pushmatic circuit breakers and Electri-Center panelboards. BullDog Electric Products Company, Dept. WD93, Detroit 32, Mich.

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BULLDOG
ELECTRIC PRODUCTS COMPANY

THE PROBLEM: changes in line voltage characteristics of synchronous converters

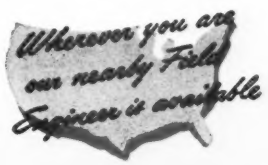
National has the answer

National engineers weren't stumped when a customer needed increased voltage from four synchronous converters. National redesign, made effective by National rewinding and National insulating materials, produced the required increase without loss of capacity.

In answer to another synchronous converter problem, National engineers proposed substantial voltage reductions which resulted in a 26% increase in the capacity of the National-rebuilt sets.

National engineers can redesign your apparatus to enable it to meet changing requirements. National craftsmen, working with National materials, can handle any rewinding job. National field engineers will supervise on-the-spot rebuilding of equipment too big to ship.

If you have a problem with any piece of rotating electrical equipment, it will pay you to consult National.



NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Wagner
TRANSFORMERS
...the choice of leaders
in industry

Specify Wagner

They meet the NEW EEI-NEMA standards
and offer many PLUS features

No matter how varied your requirements may be, the Wagner line of Distribution Transformers will meet those requirements. *The line includes every rating and design listed in the EEI-NEMA Fifth Report.* When you specify WAGNER, you know that you'll get all the standardized electrical and mechanical features that mean easier installation and greater convenience in handling and maintenance . . . But you'll get PLUS values, too! All Wagner pole-type single-phase transformers in ratings 167 kva and below are furnished with the Wagner Form W element that permits a liberal design in small size, light weight transformers that give excellent electrical performance. All Wagner pole-type transformers in round tanks have covers sealed to the tank with the Wagner SHUR-SEAL Clamping Ring that prevents "breathing" and gives true sealed-tank construction. You get extra years of service-free transformer life because Wagner Distribution Transformers are filled with an inhibited oil to reduce oxidation and retard the formation of acids and sludge.

When you specify WAGNER, you get the benefit of improved design, better performance and longer transformer life. And in addition—Wagner has a nationwide organization to provide fast, convenient service, with branches in 32 principal cities.

Get in touch with your nearby Wagner branch today. Write for your copy of Bulletin TU-180. It gives complete information on Wagner Distribution Transformers.

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Electric Corporation
EST. 1891

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

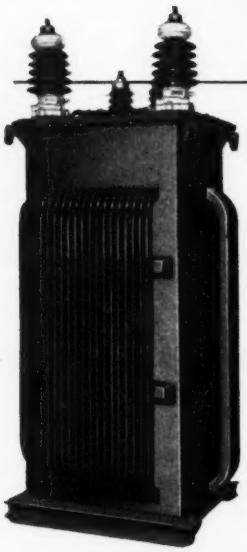
Distribution Transformers

SINGLE-PHASE

Wagner

TYPE HEB

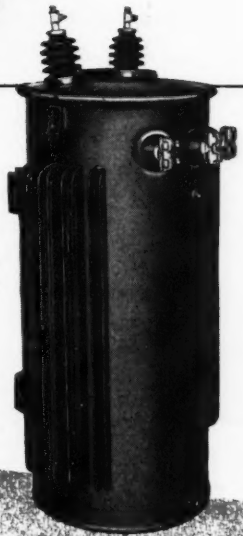
100 Kva, 2400/4160Y to 120/240 volt transformer shown.



Wagner

TYPE HEL

333 Kva, 34400 to 7200 volt transformer shown.



Wagner

TYPE HEK

50 Kva, 12000 to 120/240 volt transformer shown.

THREE-PHASE

Wagner

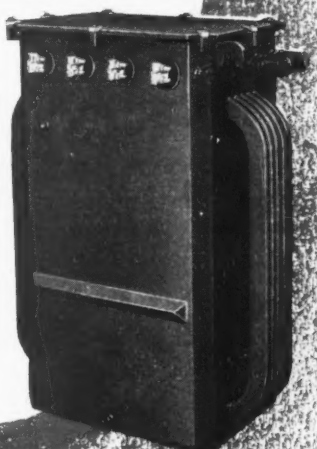
TYPE HPB VERTICAL

112.5 Kva, 2400 to 208Y/120 volt transformer shown.

Wagner

TYPE HPK

225 Kva, 7200 to 240 x 480 volt transformer shown.



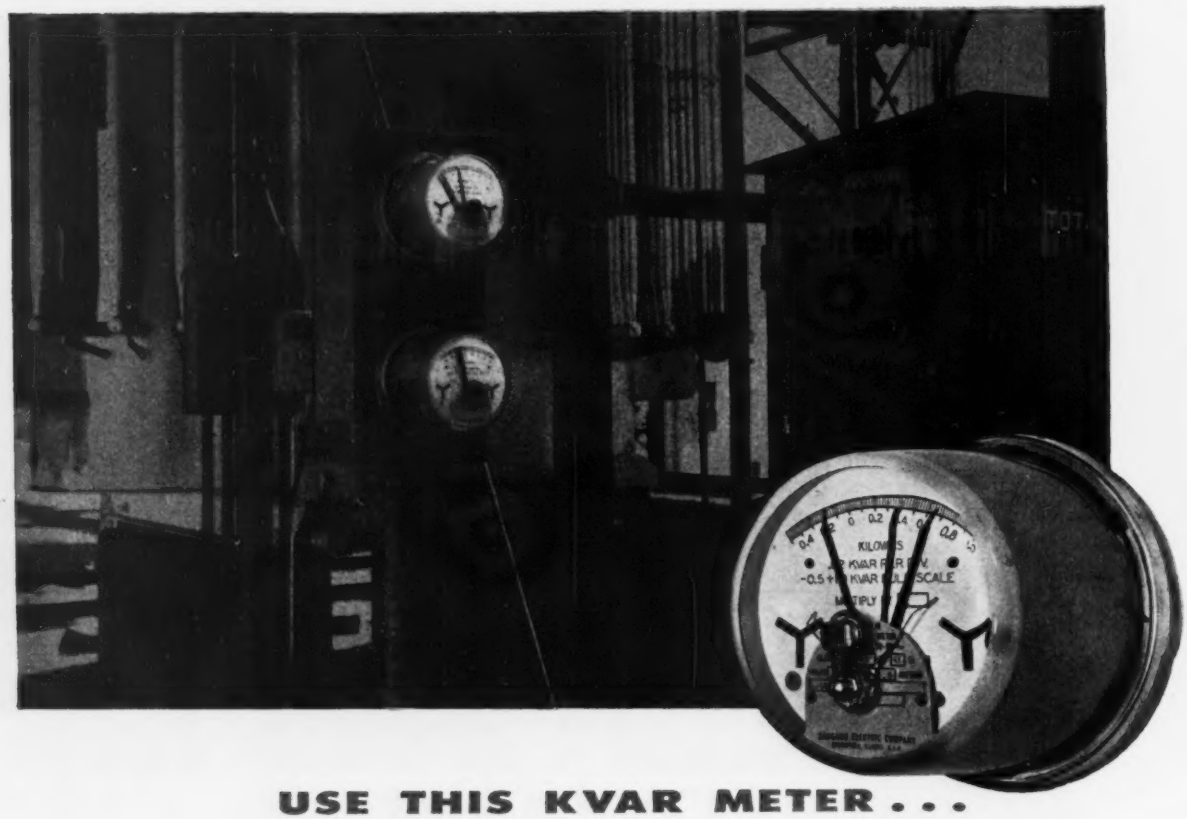
Wagner

TYPE HPB

75 Kva, 2400 to 240 x 480 volt transformer shown.

T53-13

KNOW THE REACTIVE IN YOUR SYSTEM



USE THIS KVAR METER . . .

one of the Lincoln "Indicating Meters with a Memory"

Distribution engineers are increasing system capacity by the application of capacitors to correct for reactive power which may be limiting full use of present facilities. This practice also effects economies in operation. However, accurate knowledge of the load at all times is vital to proper capacitor application.

Permanent installations of Lincoln KVAR Indicating Meters give these necessary facts. They tell the existing reactive demand, whether lagging or leading, and remember the full variation of the KVAR demand which occurred since resetting. Lincoln Meters are rugged and accurate, and they require practically no maintenance.

Full information is given in Bulletins 440 and 410. They're yours for the asking.

* * *

Have you received your copy of "Solving Distribution System Problems through Measurement"? It provides the answer to your load growth problems. We'll be glad to send you a copy.

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ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SANGAMO

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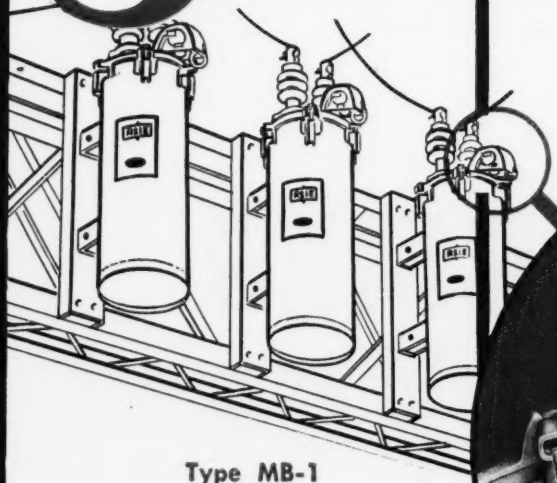
Safer



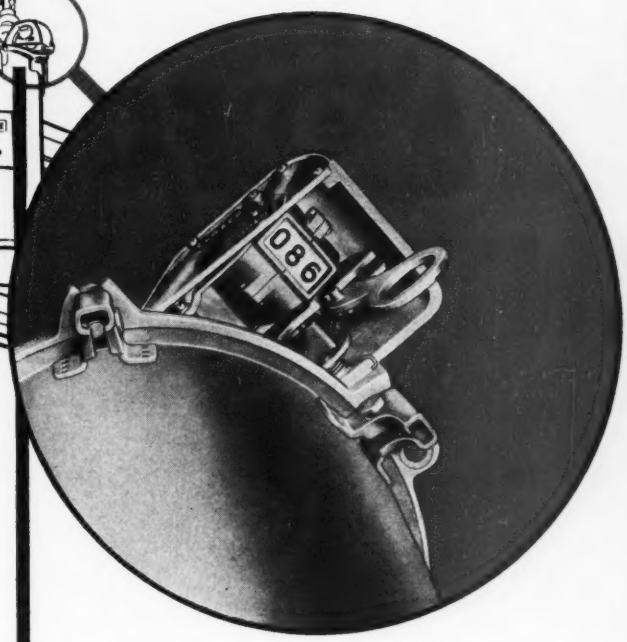
Type MB-1

CONTINOUS DUTY UP TO 280 AMPERES

- *High interrupting capacity —up to 6000 amperes!*
- *Load currents—100, 140, 200 and 280 amps.*
- *Improved fuse coordination —"lightning fast" (1½ cycle initial tripping) followed by-*
- *Selective delayed subsequent tripping (adjustable inverse time, or adjustable definite time).*

For full operating data send today for Bulletin 1550A.

Now you can count RECLOSER OPERATIONS *from the ground*



"A life could have been saved" with the counter on . . .

R&IE

AUTOMATIC RECLOSERS

In a recently published bulletin containing a summary of fatal accidents within the electric light and power industry, one item reported that a lineman was killed when he moved on a pole and contacted a live open cutout while reading the counter on a recloser.

The R&IE Automatic Circuit Recloser eliminates a danger of this type . . . it is the only recloser manufactured that includes a large digit counter, visible and easily readable from ground level without the aid of binoculars or similar devices. Another R&IE safety feature!

R&IE RECLOSER EQUIPMENT

DIVISION OF I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC RECLOSING EQUIPMENT

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ALLIS-CHALMERS

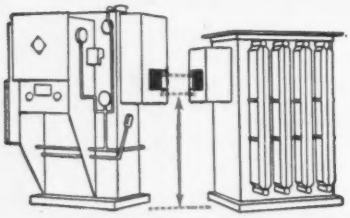
MULTI-CIRCUIT

Unit Substations

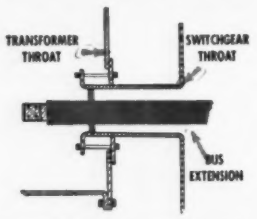
For Easy TRANSFORMER INTERCHANGE

Install A-C Unit Subs That Can Be Expanded to Keep Pace with Your System Growth

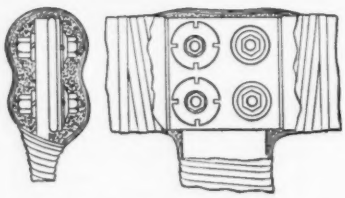
Here's Why Transformers Are Easy to Change



1 **A HIGHER CAPACITY TRANSFORMER** —within the limits of breaker size and bus capacity — can easily replace the installed transformer. Substation design permits one transformer to be replaced by another of larger rating easily and simply in the field.

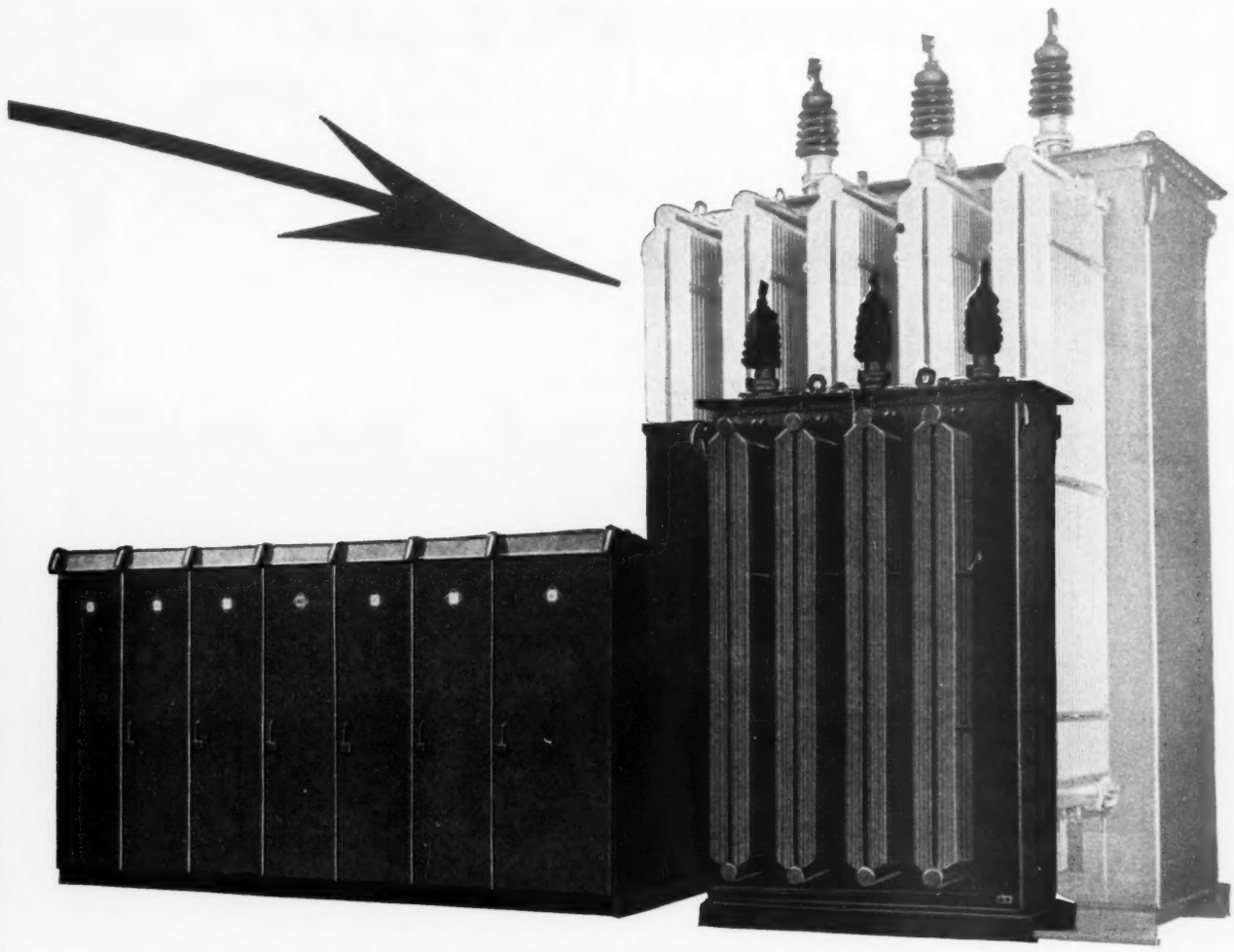


2 **FLEXIBILITY** to meet field conditions is built into the throat construction of Allis-Chalmers Unit Substations. Because of this, mechanical and electrical connections are easy to make. Normal irregularities in concrete surfaces affecting alignment can be tolerated.



3 **BUS JOINTS** are easy to make in the field. Bus extensions are predrilled and silver plated . . . designed for quick, easy bolting together. No-corona tape covers the bolted joint. Insulating tape finishes the joint. There's no compound to melt or apply.

ALLIS-



WHEN LOAD GROWTH demands additional power, the Allis-Chalmers Unit Substation you install today will be easy to modify. The installed transformer will be easy to replace with a new transformer of larger capacity.

Simplified Mechanical Connections Cut Changeover Time

Your service crew will find fewer connections to make — and these at a lower, more convenient level than the connections of most piecemeal substations.

Throat locations have been carefully established so that an Allis-Chalmers substation transformer of any rating can be replaced by a larger one. Bus and throat connections have sufficient flexibility to permit realistic tolerances for pad construction.

The time interval for changeover is further reduced by the use of bolted and taped bus joints to speed up electrical connections. Time is saved because there's no compound to melt, chip, or scrape.

Because Allis-Chalmers Unit Substations are designed to grow with your system, they are a convenient answer to the growing distribution problem . . . to the ever increasing demand for power and yet more power. They are simple to specify, neat and modern in appearance, and easy to expand.

You Save These Five Ways

(1) Original equipment cost is low; (2) compact construction reduces space requirements and real estate costs; (3) pre-wired unit design speeds installation; (4) maintenance is quick and economical because of improved accessibility; and (5) you purchase only the equipment you need *now*, deferring additional expense until load growth demands the expenditure.

For the full story on what Allis-Chalmers Unit Substations can mean in your distribution system, call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3807

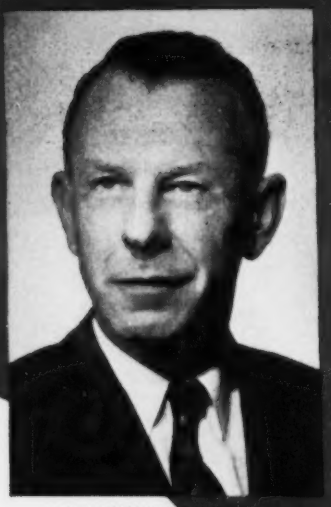
CHALMERS

A-C ALLIS-CHALMERS

"TRANSFORMERS?

...you'll get an exceptionally efficient and complete design engineering service at

Central



W. R. PHILLIPS, Ch... Central Transform... Corp.

"Experienced, capable personnel is a 'must' for complete and exact engineering service. Engineers at Central Transformer Corp. are fully prepared to design multi-winding and special application transformers, as well as standard NEMA ratings.

"In our new building, facilities for complete electrical tests, including impulse, will implement the broad development program required for consistent quality and performance of Central Transformers."

— W. R. Phillips

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION NEMA MEMBER

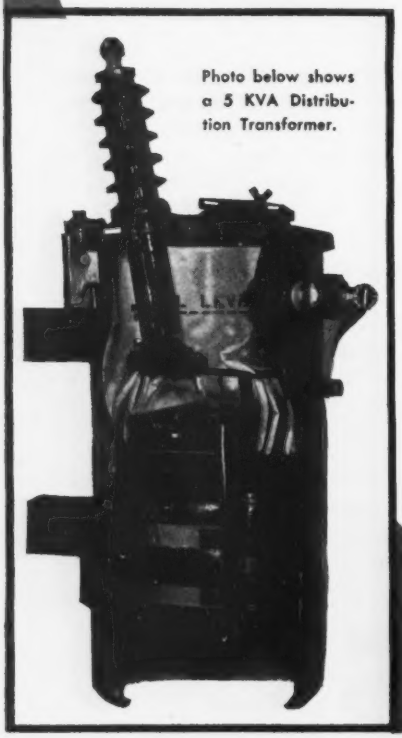


Photo below shows a 5 KVA Distribution Transformer.

Let us design your next special application transformer

Send us (or give our representative in your territory) your requirements and specifications. We'll gladly prepare for you a comprehensive recommendation. Write us today.

A TYPE FOR EVERY NEED

Oil- or askarel-immersed transformers to 15000 KVA. Three phase, class "B" dry type transformers to 2500 KVA three phase.

"Designed to Eliminate Radio Interference"

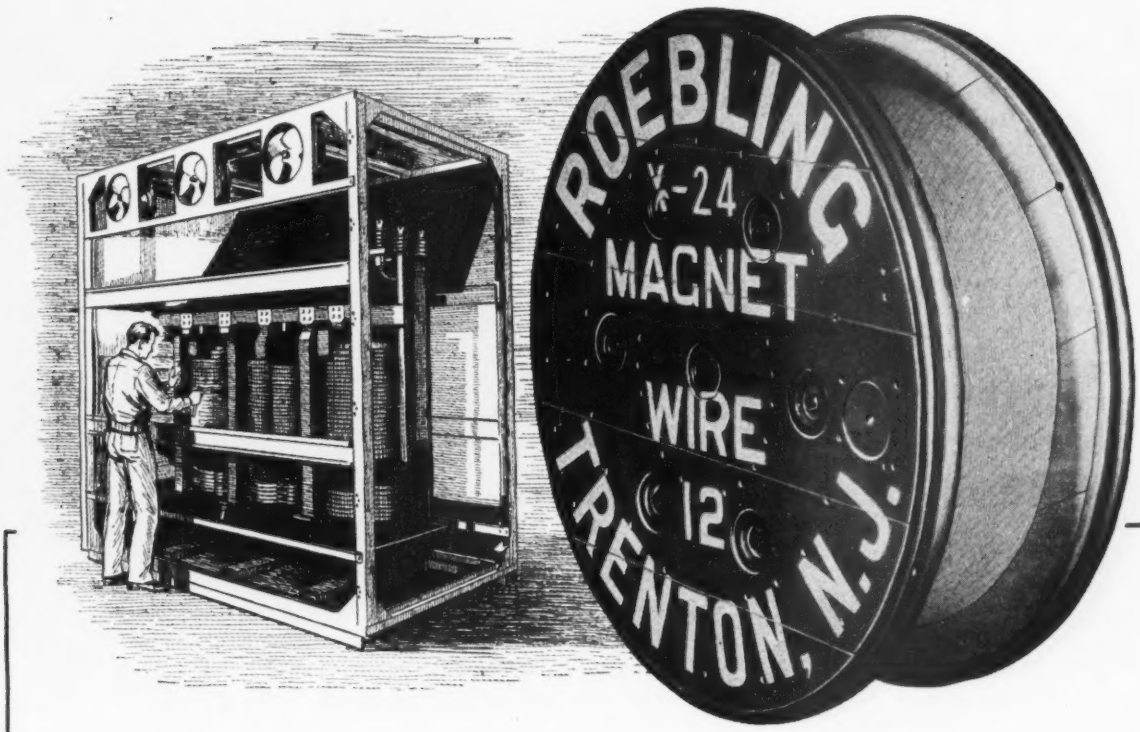
CTC

PINE BLUFF ARKANSAS

Central TRANSFORMER CORP.

Now...a new high temperature magnet wire...

ROEBLING ROETEMP



ROETEMP MAGNET WIRE brings you a brand new and superior type of insulation for applications that involve high operating temperatures. Its heat-resistant properties and dielectric strength, its extra toughness and working ease make this new Roebling ROETEMP your top choice for Class B, dry-type transformer windings, and for other electro-magnetic devices designed for operation with hot spot temperatures of 130°C (266°F).

Roebling ROETEMP Magnet Wire is insulated with a specially processed tape applied in a single wrap with a liberal overlap. It is exceptionally pliable and bends without cracking or separating from the conductor. It won't unravel; is ideal for higher speed winding; comes in a range of sizes from #1 to #12 AWG, round, square and rectangular.

Write for full data on Roebling ROETEMP Magnet Wire...and Roebling silicone bonded ROEGLAS wires for special temperature problems. John A. Roebling's Sons Corp., Trenton 2, N. J.

A subsidiary of The Colorado Fuel and Iron Corporation

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Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.

· Bartlett branches stem from research

Bartlett branch offices are conveniently located and staffed by competent, highly-skilled diagnosticians and dendricians. They can be relied on to handle your shade tree problems skillfully and to your satisfaction.

But in employing Bartlett to handle your tree problems . . . you get a big plus. When you consult with Bartlett, you get the benefit of the combined scientific knowledge and long practice of a group including some of the nation's leading authorities in tree health and protection. Scientists are continually searching for new and better ways to protect the shade trees of America at the Bartlett Tree Research Laboratories in Stamford, Connecticut. So, any decision your Bartlett Representative makes is not based on his own individual judgment . . . it's based on years of experience of the whole Bartlett organization.

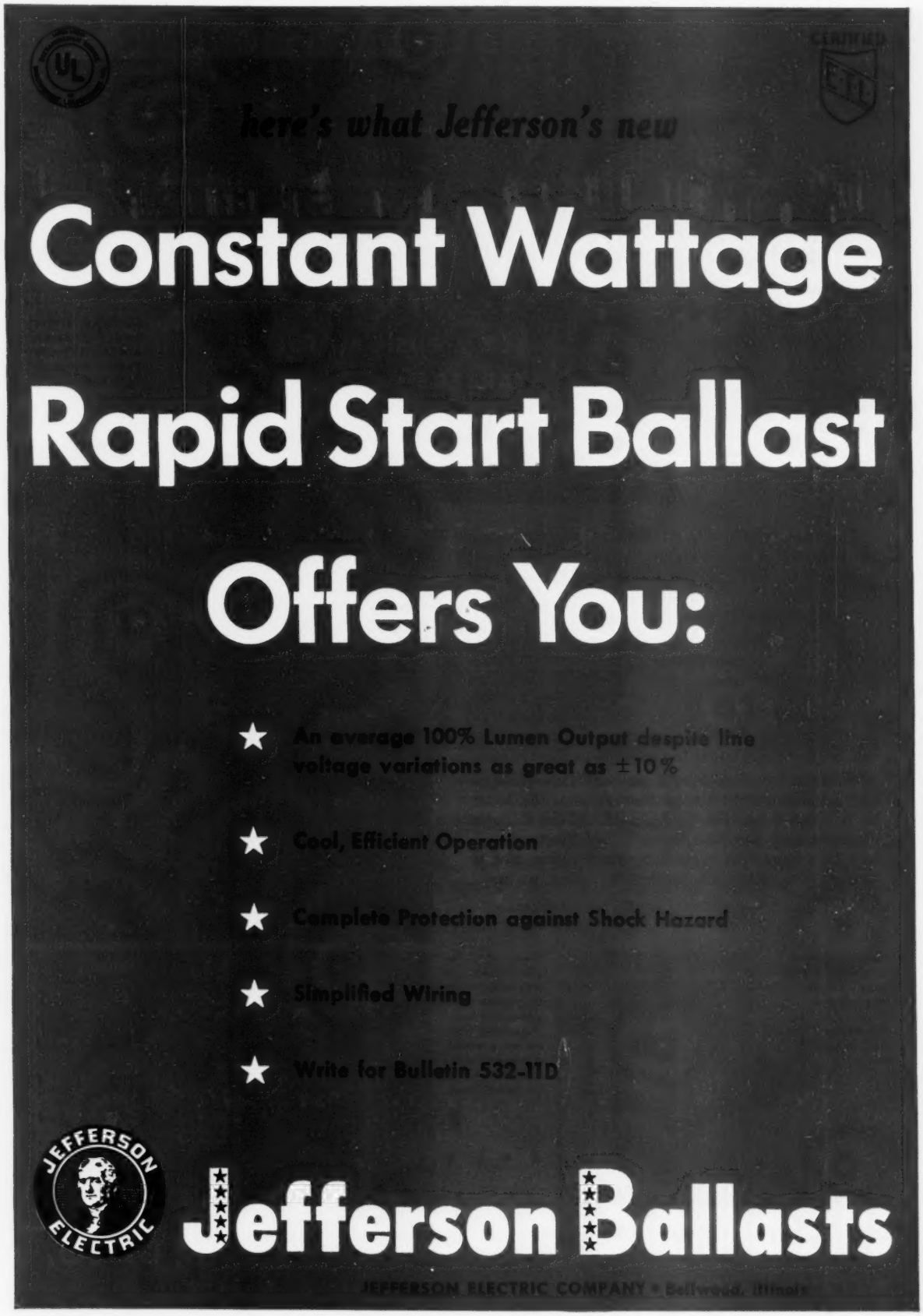
That's why a great many Bartlett clients engage Bartlett services on a yearly basis to care for their trees and guard them against insects and disease. They appreciate the continual improvements and advancements the Bartlett Way provides.

No wonder those who are critical of results are turning more and more to the Bartlett Way. You, too, can benefit by Bartlett services. Call the nearest Bartlett office for a study of your tree condition.

The Bartlett Way

BARTLETT TREE EXPERTS, *Stamford, Conn.*

Branch Offices: Rutland, Windsor, Vt.; Concord, Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Osterville, Pittsfield, Prides Crossing, Mass ; East Providence, R. I.; Danbury, Hartford, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Southampton, Syracuse, Westbury, White Plains, Yorktown Heights, N. Y.; Bernardsville, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Zanesville, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Charleston, Huntington, W. Va.; Kingsport, Tenn.


here's what Jefferson's new
Constant Wattage
Rapid Start Ballast
Offers You:
★ An average 100% Lumen Output despite line voltage variations as great as ±10%
★ Cool, Efficient Operation
★ Complete Protection against Shock Hazard
★ Simplified Wiring
★ Write for Bulletin 532-11D
JEFFERSON ELECTRIC
Jefferson Ballasts
JEFFERSON ELECTRIC COMPANY • Bellwood, Illinois

THIS IS THE WAY
THEY USED TO DO IT . . .
using manual starters, taking electrician's time to start and properly synchronize the 440-volt synchronous motors.

NOW . . .

EC&M PUSH BUTTON STARTERS Synchronize Motors *Automatically* . . . Save Time . . . Do the Job *Better.*

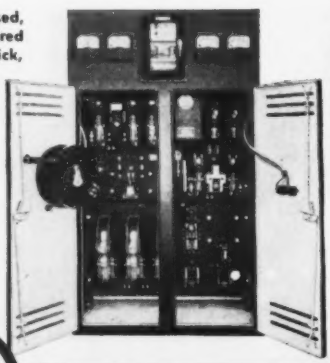
No false starts now. Push Button and Clutch Control Panel alongside each motor out in the mill.

The change-over to push button operation in this plant is typical of what is taking place in this push button age. The savings, safety, and greater efficiency of push button operation account for its increasing popularity.

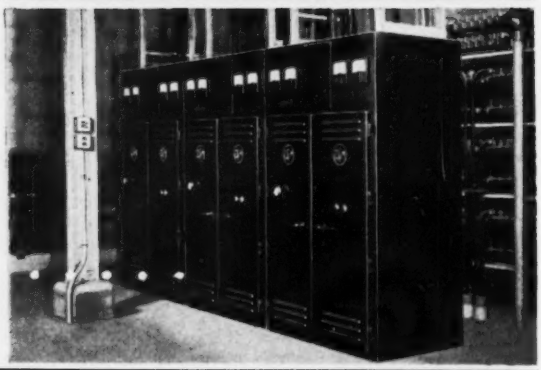
As the motor approaches synchronous speed, Field Control is *automatic* by the Polarized Field-Frequency Method. Excitation of the field occurs at a point most favorable to locking the motor into synchronism. *Field removal* and *re-application* occur automatically should a voltage dip or overload momentarily cause the motor to pull out of step.

We build Synchronous Starters for all low voltages and for 2300-4600 volt power systems. Bulletins 1076-7 and 8 and No. 21 ACCELERATOR Bulletin illustrate and describe these EC&M Starters, and how they save time in getting synchronous motors on the line under full protection. May we send you copies?

Totally enclosed, completely wired units . . . quick, low-cost installation. No expensive control room.



Group of 3 Reduced Voltage Resistor-type Starters for Ohio cement plant. Three other starters are similarly grouped on overhead balcony in the control room.



THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET ★ CLEVELAND 4, OHIO

11,362 square foot exterior of this laboratory erected by 5 men in 25 days

with Stainless Steel Panel Construction

CORNER AND WINDOW VIEW of the Laboratory showing how effectively the two types of panels are combined in this building.

TWO TYPES of Stainless Steel panels—fluted-face and flat-face—combine to give the Metallurgical Laboratory at United States Steel's Fairless Works an attractive exterior. Architect: Hoffman and Crumpton, Pittsburgh, Pa. General Contractor: Joseph R. Farrell, Inc., Philadelphia, Pa. Stainless Steel panels fabricated and erected by The H. H. Robertson Company, Pittsburgh.

For buildings that must have pleasing appearance, be easy and inexpensive to maintain, yet can be erected quickly in any weather, Stainless Steel Panel Construction is the ideal method.

One of the latest examples of this type of construction is the Metallurgical Laboratory at Fairless Works of United States Steel Corporation, Morrisville, Pa. A crew of five men and a foreman installed the 11,362 square feet of insulated Stainless Steel panels in 25 working days.

This type of construction can be carried out with Stainless Steel panels that are insulated or non-insulated, depending upon the purpose of the building. The low coefficient of thermal transmission of the insulated panels makes them particularly efficient in regard to heating and air conditioning costs.

If you are interested in Stainless Steel Panel Construction, send for our book, "Walls and Roofs for Industrial Buildings." Use the coupon below.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • NATIONAL TUBE DIVISION, PITTSBURGH
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U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES
BARS · BILLETS
USS
PIPE · TUBES · WIRE
SPECIAL SECTIONS

United States Steel Corporation
525 William Penn Place, Room 2816-Z
Pittsburgh 30, Pa.

☐ Please send me your new booklet on U·S·S 17 Stainless Steel for industrial buildings.

☐ Please arrange to have fabricators of Stainless Steel wall panels send me literature on their particular type of construction.

Name..... Title.....

Address.....

City..... State.....

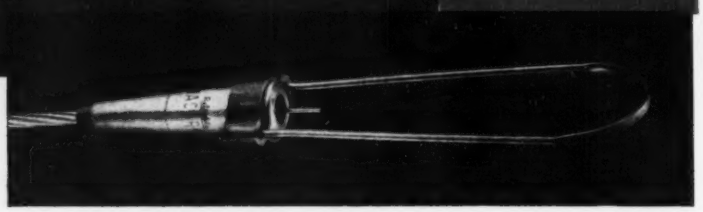
United States Steel produces only the Stainless Steel sheet and strip from which panels of this type are made; the panels themselves are fabricated by a number of our customers.

3-1856A

UNITED STATES STEEL

NEW Reliable PILOT CUP TYPE "STRAIGHTLINE" SPLICE *for* ACSR

With one jaw removed it can be seen how core wire, when bared approximately 3", feeds pilot hole in jaw washer to be properly located in gripping chuck and permit aluminum strands to enter splice.



Two-level gripping chuck holds steel core and aluminum conductors.

- develops ultimate strength of ACSR.
- makes an electrical connection of low resistance at minimum tensions.

DEADEND IS OF SAME DESIGN A straightline deadend for ASCR is assembled to conductor following same instructions as for splice. Only the steel core wire feeds thru. Deadend bail is stainless steel.

features:

1. Pilot cup in each end of the splice permits bared steel core to run thru core gripping area.
2. Pilot cup then caps aluminum strands to guide them to their proper location in the gripping chuck. Aluminum strands cannot enter the splice unless core wire is first properly located.
3. Bent or out-of-lay strand or burred conductors cannot catch in the jaws. They are refused or covered by the pilot cup. If they go in the pilot cup they are guided through the jaws and are properly located.
4. Splices and deadends are grease packed and packaged in plastic. All working parts and all surfaces are factory coated with corrosion inhibitor No-Oxid oil.

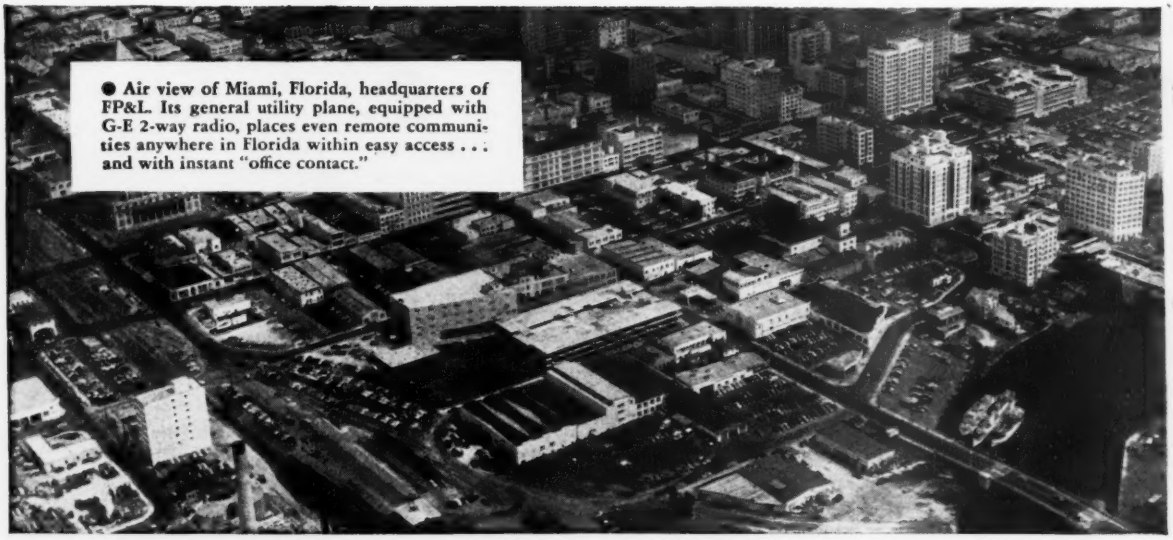
Write for new bulletin giving complete information. Reliable will gladly give you a demonstration — simply ask for it on your company letterhead.

Reliable **ELECTRIC COMPANY**

3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES



● Air view of Miami, Florida, headquarters of FP&L. Its general utility plane, equipped with G-E 2-way radio, places even remote communities anywhere in Florida within easy access . . . and with instant "office contact."

G-E 2-WAY RADIO HELPS FP&L KEEP PACE WITH FAST GROWING FLORIDA

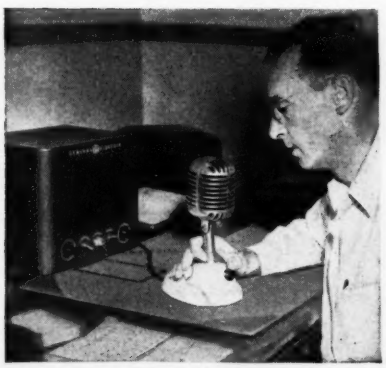
FIVE years ago, Florida Power & Light Co. called in G-E communications advisors to help plan a 2-way radio system which would incorporate an air-ground patrol of all facilities. Realizing the value of instant communications, FP&L took this step to increase the efficiency of a statewide mobile and base station network.

Indicative of Florida's rapid growth, FP&L has stepped up its generating capability 162% since V-J Day! Dependable communications are doubly important today. Air-ground contact with base and mobile units enables company officials to expedite routine jobs—save valuable time!

Today, Ken Shotwell, FP&L official, has this to say: "We rely on our G-E units. Instant communication with our offices increases the ability of our folks to get around the system more frequently. This makes for better operations, better human relations all around."

The CAS* man in a local G-E office can offer valuable advice concerning the specialized requirements of your communications problem. Consult him today or write: *General Electric Co., Section 1993-21, Electronics Park, Syracuse, N. Y.*

*Communications Advisory Service



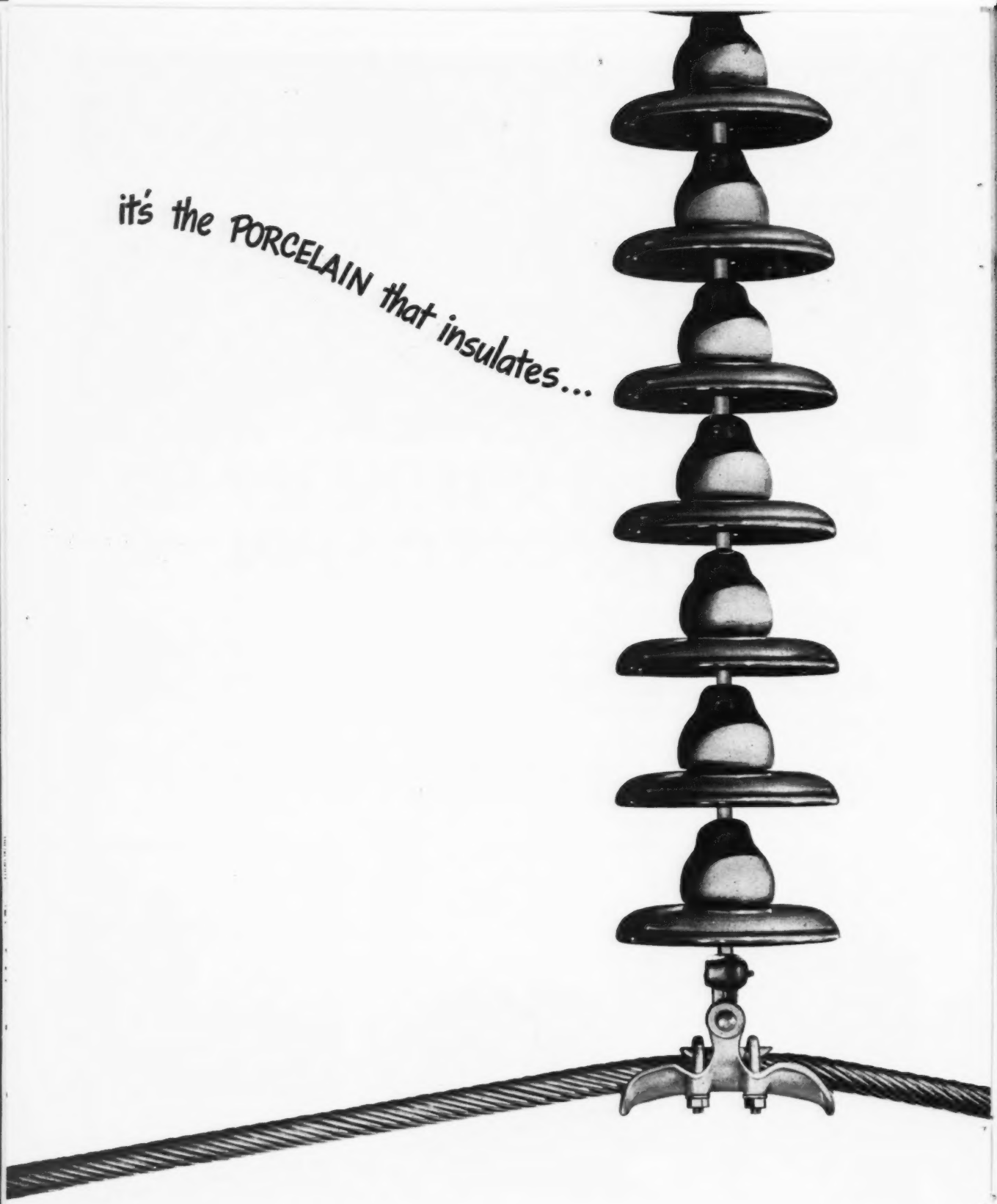
● F. J. Norton, communications supervisor, relays instructions from a base station to a mobile repair truck. "Radio dispatching speeds service restoration, saves time and money. This kind of efficient operation helps utility companies keep electric rates low," he says.

● A line crew follows up report of broken insulators detected by air patrol . . . makes repairs before real damage develops. FP&L men refer to their 2-way radio system as the workhorse of the company.

● Ken Shotwell, assistant to the company vice president, checks flight plans with J. A. Majewski before departing from Miami's Tamiami Airport. Their General Electric 2-way radio will give instant communication with ground base stations and mobile units.

GENERAL ELECTRIC

it's the PORCELAIN that insulates...



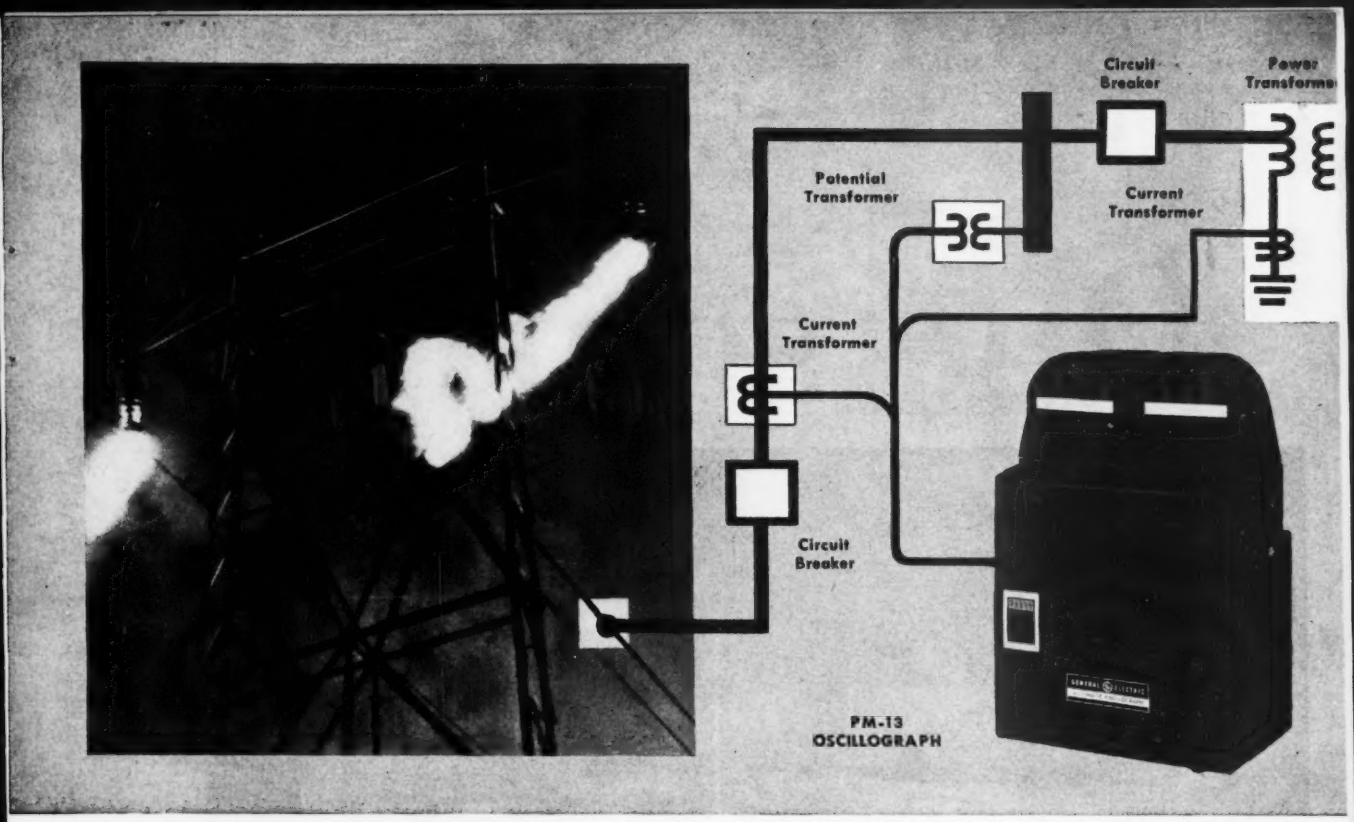
LAPP PORCELAIN

IS YOUR GUARANTEE

OF LONG INSULATOR LIFE

Insulator life depends on soundness of porcelain, and on assembly which gives it the best chance to live. For greatest insulator serviceability, look to the quality of the porcelain, and to assembly which recognizes the physical characteristics of the porcelain. Nowhere have these two requirements been the subject of more study, nor the object of more production care than at Lapp. The Lapp reputation for porcelain quality is ample basis for your confidence in the specification *"Lapp Suspension Insulators."*

Lapp Insulator Co., Inc., Le Roy, N. Y.



TRANSMISSION-LINE FAULT (ACTUAL PHOTO) CAUSED BY LIGHTNING IS AUTOMATICALLY RECORDED BY GENERAL ELECTRIC OSCILLOGRAPH.

NEW FEATURES INCLUDING 7-TRACE DESIGN HELP YOU TO . . .

Analyze System Faults Easier with a G-E Oscillograph

Designed to automatically record power system transient disturbances, General Electric's new PM-13 oscillograph now makes possible seven simultaneous traces. The oscillograph records quantities pre-selected by the system engineer such as ground current, line current, phase/ground potential, phase/phase potential, and Kw or Kva.

NEW LIGHT SOURCE

A flooding-type light source illuminates all seven of the new instrument's galvanometers. Because no lenses, prisms, or apertures are used, no time-consuming optical adjustments are necessary when replacing lamps.

IMPROVED TIME RECORDER

The new PM-13 oscillograph is equipped with an automatic time recorder which photographically records the time and date of operation on the face of the oscillogram. For station or company identification, a plate may be added to the time mechanism.

UNIT CONSTRUCTION

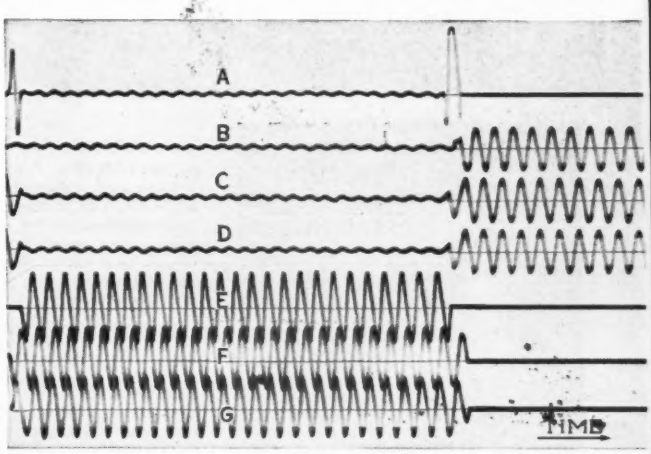
Constructed of simplified unit subassemblies, the front relay panel of the new G-E oscillograph is easier to inspect and maintain.

SIMPLIFIED PAPER HOLDERS

New, light-tight record paper holders mount easily on the top of the oscillograph. Holding up to 200 feet of record paper, the new holders make it possible to obtain as many as 100 oscillograms.

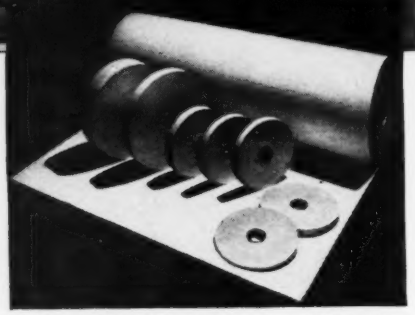
FURTHER INFORMATION

For further information, contact your local G-E Apparatus representative, or write for Bulletin GEC-396 to: Section 605-51, General Electric, Schenectady 5, N. Y.



OSCILLOGRAM SHOWS WAVE FORMS of ground current, line current, and phase/phase voltages resulting from lightning fault.

GENERAL ELECTRIC



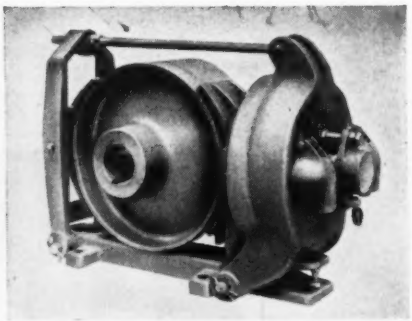
Quinorgo Electrical Insulations are high dielectric, heat-resistant sheet materials made of purified asbestos for use on equipment up to 130 C. Available in tape and roll forms.

How Cutler-Hammer, Inc. protects coils of giant Supermagnets with Quinorgo® electrical insulation

PROTECTING COILS in giant C-H Supermagnets is difficult because of the heat generated by the tightly packed pancake coils. This problem is complicated by the need to utilize every bit of space to gain maximum lifting power. After experimenting with many insulating materials, including coatings, Cutler-Hammer chose Quinorgo No. 3000 for Supermagnet strap insulation.

Quinorgo fully meets the exacting requirements of Cutler-Hammer—as well as those of other well-known electrical manufacturers. Quinorgo is a moderate priced, high-temperature insulation, for use alone or in "composites." Available in two types with slightly different impregnation characteristics. Both types combine high dielectric and mechanical strengths, with uniform texture and caliper. They maintain these properties under operating temperatures up to 130 C.

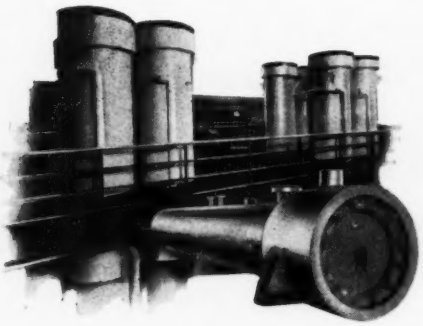
Quinorgo Electrical Insulations may lower your production costs and improve product performance. For more information write for the 32-page booklet "PYROLYSIS PROTECTION PAYS WELL" (EL-40A) Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.



Cutler-Hammer's success with Quinorgo No. 3000 on giant Supermagnets led the company to use this insulation as a component of the series wound Type "M" magnetic brakes which are so widely known throughout the industry.

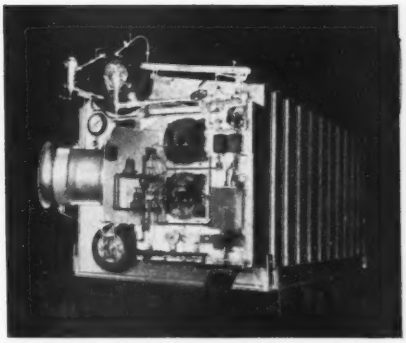
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS



PACKAGE STEAM GENERATORS in capacities of 10,000 to 30,000 lb. of steam per hr. Water-tube type, plant assembled, shipped ready to install. Design pressures of 250, 525, 825 psig provide operating pressures from 100 to 800 psig.

FEEDWATER HEATERS of the shell-and-tube type, as well as direct contact arrangements, are available. "Lockhead" closures have been built for pressures up to 3500 psi.

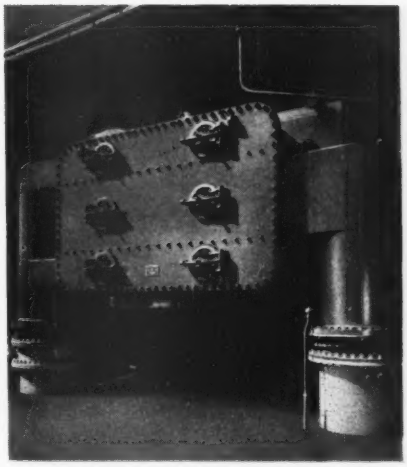


many of your steam plant needs

Only Foster Wheeler offers such a broad line of steam plant equipment engineered for increased efficiency through modernization.

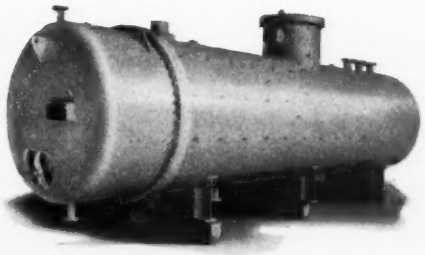
IN OVER 50 YEARS of service to the power industry, Foster Wheeler has pioneered the development of steam generators, fuel systems, condensers and cooling systems of the highest efficiency. Continuous research and engineering have created a background of technical experience, *as well as* an integrated line of equipment in which each individual product is designed to contribute to the efficiency of all.

FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.



CONDENSERS to meet any conditions of headroom at any location. Our shops are fully equipped to supply units of 100,000 sq. ft. and larger.

EVAPORATORS for boiler feed make-up and of heat-transformer types in all sizes. Special types to handle raw and treated make-up to give the best thermal and descaling operation as well as producing pure vapor.



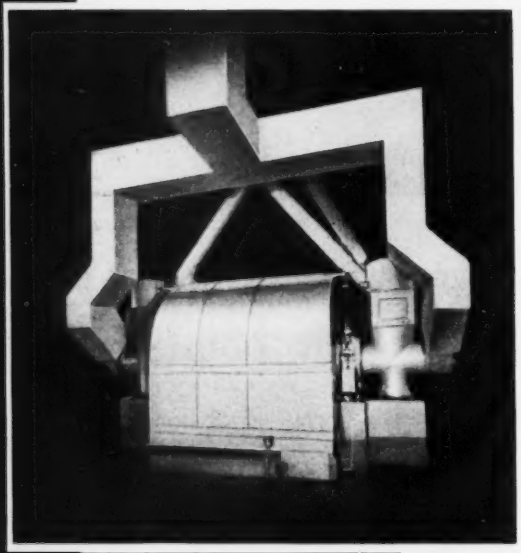
COOLING TOWERS custom-engineered to meet your requirements for greatest economy. Mechanical draft, counter-flow type. Provide minimum spray loss, flexibility to meet all weather conditions.

FOSTER WHEELER

One source

... meets

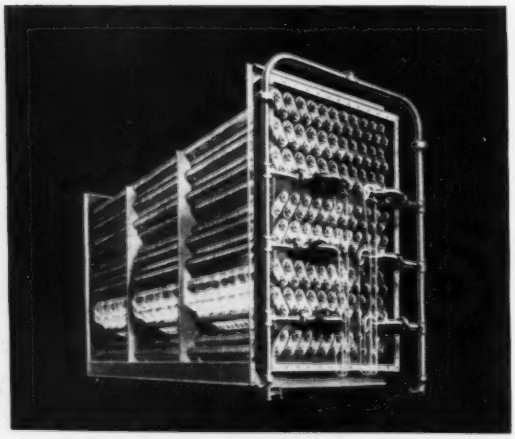
STEAM GENERATORS for every central station or industrial use, designed, engineered and built to meet your needs for the economies of higher temperatures and pressures over control ranges not previously obtainable.



BALL MILL PULVERIZERS which grind hard, abrasive fuels to a constant fineness. Operating records show low maintenance, high availability of 99% or better.

SUPERHEATERS of the convection and radiant type, either singly or in combination. Superheat control over a wide load range is also offered as a means of positive and accurate control of final temperature.

ECONOMIZERS of the cast-iron, extended-surface steel-tube type which are corrosion-resistant, impervious to soot fires, easily cleaned, and of unique, simple design. Bare tube construction also available.



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BUS FITTINGS and CONNECTORS

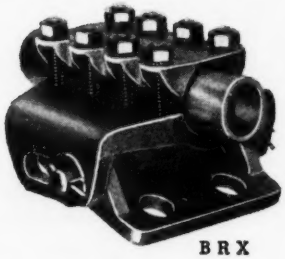
TOP QUALITY—Highest standards in design, materials and workmanship.

COMPLETE LINE—Prompt service on special requirements.

LOW PRICES—Economy prices for quality fittings.

RAPID DELIVERY—Standard items—stock to one week.

TBS



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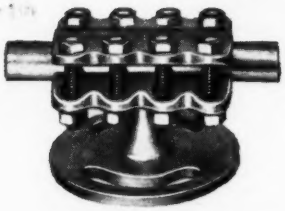

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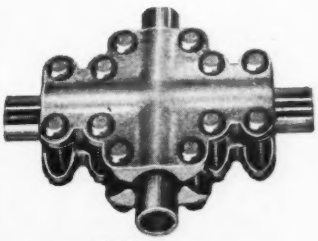

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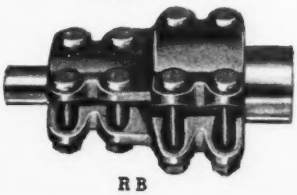

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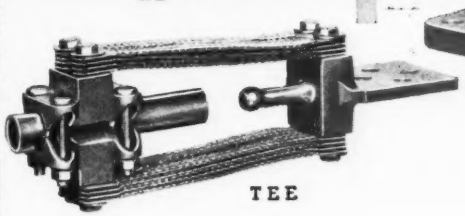

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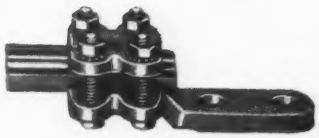

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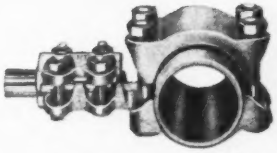

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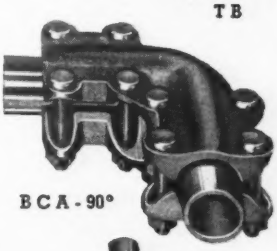
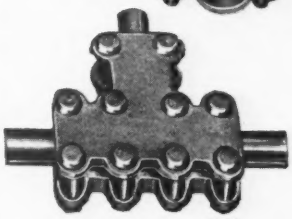


BCA - 90°



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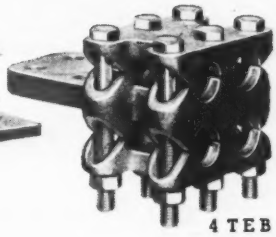

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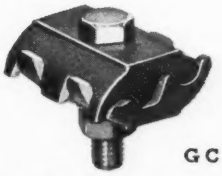

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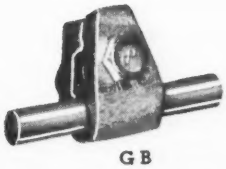


GB

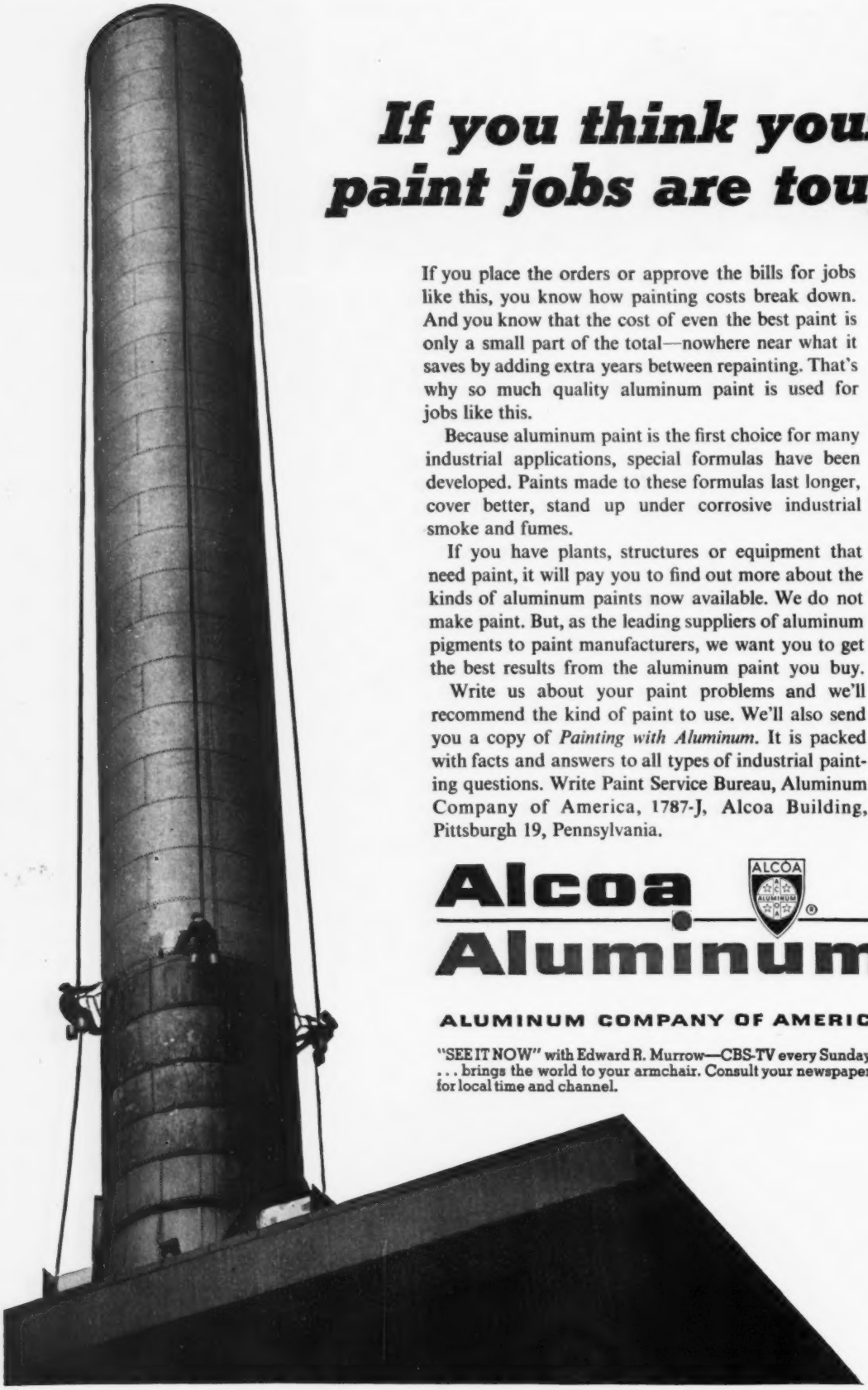
GP

SCHWAGER-WOOD CORPORATION

High Voltage Switchgear • Substation Design, Equipment • Bus Fittings and Connectors

8024 S. W. 35th AVENUE • PORTLAND, OREGON • PHONE CHerry 7588

Sales offices in principal U. S. cities.
Additional information and prices available on request.



If you think your paint jobs are tough

If you place the orders or approve the bills for jobs like this, you know how painting costs break down. And you know that the cost of even the best paint is only a small part of the total—nowhere near what it saves by adding extra years between repainting. That's why so much quality aluminum paint is used for jobs like this.

Because aluminum paint is the first choice for many industrial applications, special formulas have been developed. Paints made to these formulas last longer, cover better, stand up under corrosive industrial smoke and fumes.

If you have plants, structures or equipment that need paint, it will pay you to find out more about the kinds of aluminum paints now available. We do not make paint. But, as the leading suppliers of aluminum pigments to paint manufacturers, we want you to get the best results from the aluminum paint you buy.

Write us about your paint problems and we'll recommend the kind of paint to use. We'll also send you a copy of *Painting with Aluminum*. It is packed with facts and answers to all types of industrial painting questions. Write Paint Service Bureau, Aluminum Company of America, 1787-J, Alcoa Building, Pittsburgh 19, Pennsylvania.

Alcoa Aluminum

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow—CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

THEY'RE PUNCTURE PROOF!

If it's on the pin, it's in service!

No more searching for defective insulators when your lines are protected with NEW Kimble *Tempered* Glass Insulators.

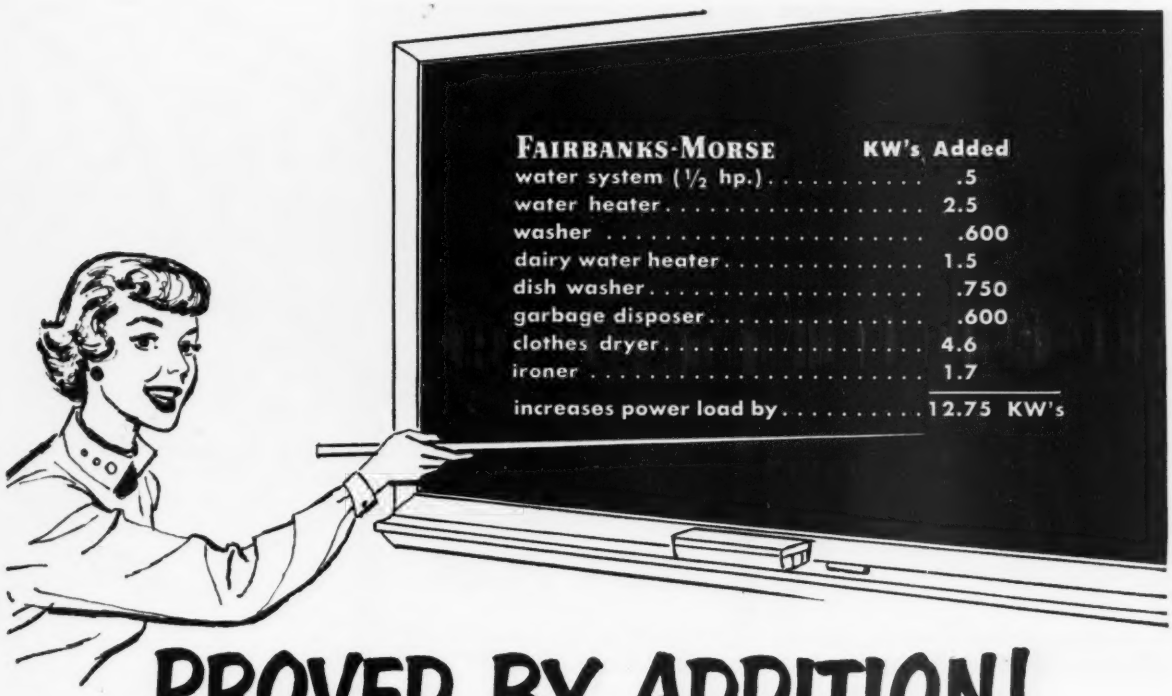
Why? Because these new insulators are puncture-proof. Exhaustive laboratory tests at values far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air—*even under voltage impulses far above normal service rating*. Four years of field testing on more than 500 miles of line have produced no puncture failures. Even lightning surges have failed to damage these new Kimble *Tempered* Glass Insulators.

In the event of shattering due to severe mechanical shock, insulator disintegrates into small non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development-in-glass that adds a new element to the many natural virtues of glass. It's an exclusive Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe tests required.

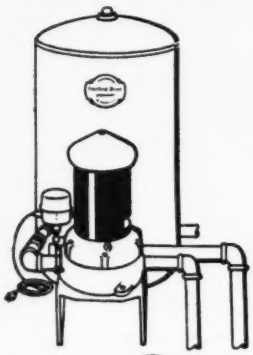
Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, Dept. EW 9, Box 1035, Toledo 1, Ohio.

KIMBLE GLASS COMPANY
Toledo 1, Ohio—*Subsidiary of Owens-Illinois Glass Company*



PROVED BY ADDITION!

FAIRBANKS-MORSE Water Systems BUILD POWER LOAD



Every time a FAIRBANKS-MORSE electric water system is installed, the KW load starts climbing.

Load-building appliances which could not be enjoyed until running water became available are bought as quickly as possible.

A water heater for the home, and another for the milk house or dairy usually come first. A modern washing machine soon follows, and with it may come the need for a dryer and an ironer.

Running water opens the way also for sales of dishwashers and garbage disposal units; for stock water tank heaters and waterers; for pipe thawers and can washers . . . all load builders!

FAIRBANKS-MORSE

a name worth remembering when you want the best

WATER SYSTEMS • GENERATING SETS • MOWERS • HAMMER MILLS • PUMPS
MAGNETOS • MOTORS • SCALES • DIESEL LOCOMOTIVES and ENGINES

what you ought to know about our water systems

Since electric water systems are *big* factors in helping you build up power loads, you ought to know all about them. So we've thought of ways to help you. We will supply you with educational wall charts on shallow well and deep well pumps; charts on plumbing hook-ups and sewage disposal layouts for average houses; booklets showing types of pumps, their capacities and uses.

Fairbanks, Morse & Co.
600 S. Michigan Ave., Chicago 5, Ill.

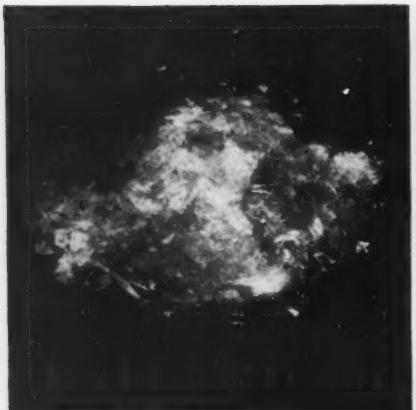
Please send a representative to show us how to use your wall charts and interpret your literature on home water systems.

Company Name .....

Your Name .....

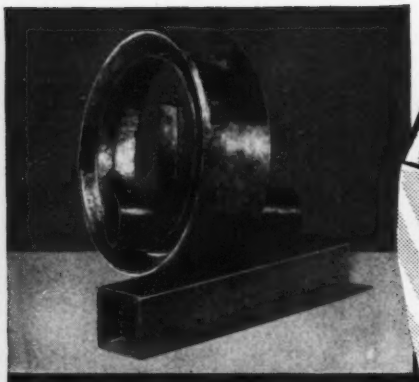
Address .....

City ..... State .....



AS WE GET IT...IT'S MICA

it needs a lot of going over before it's ready for you. We don't change its properties, but we do build them up — this way and that way until,



AS YOU GET IT . . .

IT'S

MICA PLUS -

. . . and the "plus" is . . .

MACALLEN

— experience, equipment and methods which make for precision, uniformity.

. . . to get the PLUS VALUE, SPECIFY . . .

when you think of MICA . . . think of MACALLEN

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

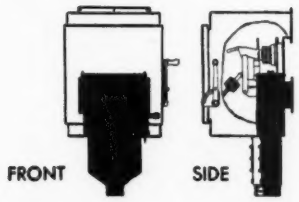
THE MACALLEN COMPANY

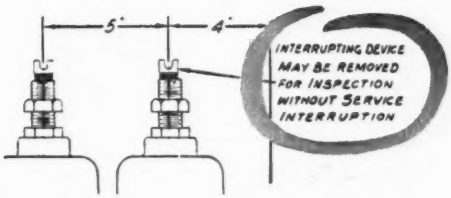
BAY ROAD, NEWMARKET, N.H.

CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

3 good reasons why 3E AIR INTERRUPTER ISOLATORS are best for transformer use

In standard procedure normal load of transformer is interrupted by an interlocked secondary breaker leaving only magnetizing current in primary circuit to be broken. The Interrupter ISOLATOR is ideal for such applications.





1 SAVES SPACE

The Air Interrupter ISOLATOR is neat and compact, occupying only one-fourth of the space required for other types of interrupting equipment.

Diagram shows space saved by superimposing a three pole, single throw, 400 ampere, 5000 volt Air Interrupter Cable ISOLATOR, with throat for transformer mounting, over equivalent air interrupter switch. Ratio is approximately 4 to 1 in favor of ISOLATOR.

2 SIMPLE TO INSTALL and MAINTAIN

Air Interrupter ISOLATORS are lighter; consequently they can be handled more easily by construction crews.

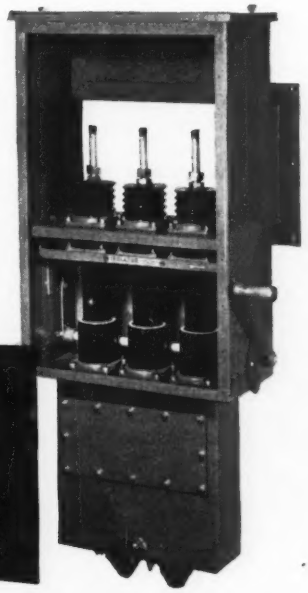
The interrupter units can be removed for inspection by means of a hot stick without clearing the circuit.

For complete data ask for new Bulletin 138.

3 ECONOMY . . . 3E PERFORMANCE EQUALS COSTLIER EQUIPMENT

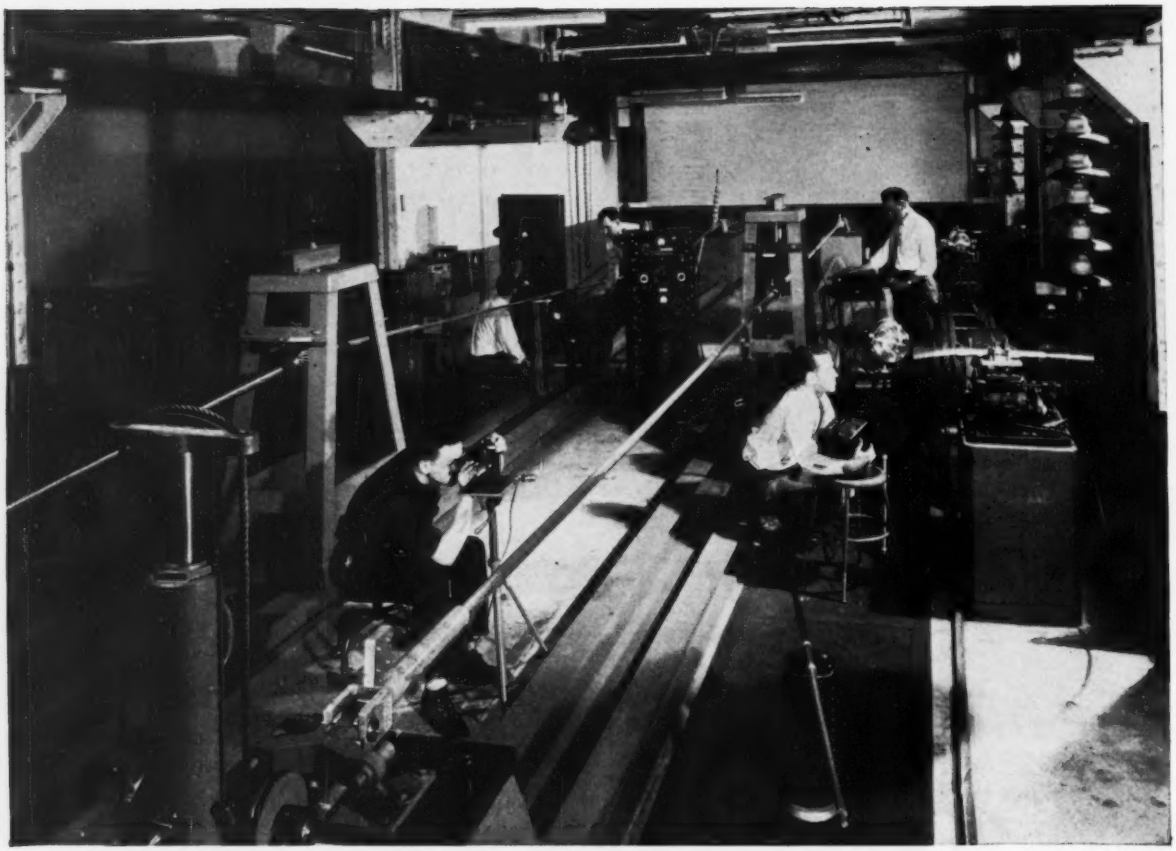
The Air Interrupter ISOLATOR will provide safe interruption at much less cost than interrupter switches or other approved devices. These ISOLATORS are built for loads up to 15,000 volts . . . and their cost is surprisingly low.

CABLE ISOLATOR
3 pole, single throw
400 Ampere, 15,000 volts.



THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS



Progressive Ideas...

backed by **EXTENSIVE RESEARCH** *and* **SOUND ENGINEERING**

insure the ultimate in **FIELD PERFORMANCE**

The "ultimate in FIELD PERFORMANCE" is the installation that assures the longest satisfactory transmission and distribution line life. In terms of armor-rod function, this means the best protection against line failure caused by:

1 — CONDUCTOR FATIGUE occasioned by a continuing increase in operating and maximum tensile stresses incident to the introduction of stronger conductors and the building of lines with longer and longer spans.

2 — ARCOVER BURNING at or near suspension clamps and LIGHTNING PITTING anywhere along the line.

3 — CORROSION AND CURRENT-TRANSFER PITTING within suspension clamps, at or near taps and under splices.

4 — UNDUE HEATING of taps, splices and so on, caused by the differential expansion of dissimilar metals or of metal stressed beyond its elastic limit.

It is almost impossible, in the case of a line failure, to isolate one or another of the causes, but with Preformed Armor Rods, it is not necessary.

PREFORMED ARMOR RODS by virtue of their inherent and unique characteristics effectively take care of all the above-mentioned problems. Conductors are relieved of mechanical stress at points of support. They are protected against burning, corrosion and overheating, and all of this is done at every point of application with almost unbelievable uniformity and consistency.

Preformed Armor Rods are today's... not yesterday's... answer for increasing conductor life.

For complete details of their outstanding and exclusive features, write or phone Cleveland: EXpress 1-3571.

"HERE'S HOW WE ADDED

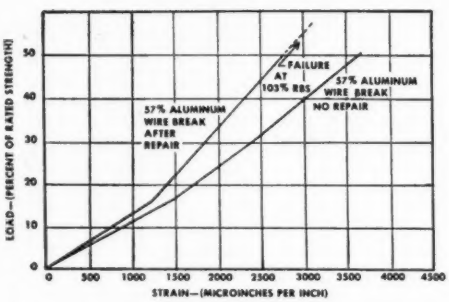
HOW *Preformed Armor Rods* LENGTHEN CONDUCTOR LIFE

★ The most vulnerable spot of a transmission line is under the suspension clamp. You can get no better armor protection than Preformed Armor Rods. They are always *uniform*—always do the same perfect job—factory engineered and factory formed—no variation in installation. Their intimate contact with the conductor provides the necessary reinforcement without any of the rub or chafe between rods and conductor, which you might expect in a looser installation. Furthermore, they will never loosen. They are not dependent on tightening of bolts which might crush the conductor if improperly applied—and which may become loose.

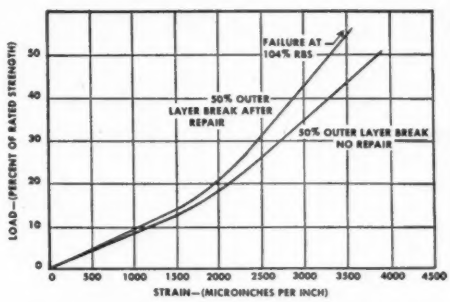
But this is only part of the story: While Preformed Armor Rods will provide the *best* and *safest* protection, they have another *unique* function—they do a job which only Preformed Rods can do. Regardless of armor efficiency, some vibration damage may occur. Should a strand failure occur at the suspension point, Preformed Rods will automatically take on the load, restoring strength and conductance—thereby continuing and lengthening conductor life.*

After all, your interest is in maintaining service—in continued functioning of your transmission lines. You need no longer consider the life of your conductor jeopardized by a strand failure. Preformed engineering has seen to this.

* Many have encountered vibration, chafing and burning failures on unarmored conductors and have used Preformed Armor for repairing and restoration of conductors at those points.



Strength restoration of No. 4, 7 x 1 ACSR (rated breaking strength—2288 lbs.) by Preformed Armor Rods.



Strength restoration of 795 MCM, 26x7 ACSR (rated breaking strength—31,200 lbs.) by Preformed Armor Rods.

These two charts tell the story. Irrespective of conductor size and construction, the clamping characteristics of PREFORMED Armor Rods result in restoration of the strength of damaged conductors to within at least 5 per cent of the rated breaking strength of the original conductors. And remember . . . only with PREFORMED Armor Rods . . . can laboratory tests accurately predict field service performance. There are no "average" installations.

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Commercial Cooking Success Story...

HOW TO MAKE AN "EXTRA" MILLION DOLLARS EVERY YEAR

By J. M. Stedman, General Sales Manager, Pennsylvania Power & Light Co.

Five years ago Pennsylvania Power & Light Co. discovered an important new source of revenue—commercial cooking.

Today it is one of our major sources of new commercial income—accounting for 8% of all revenues derived from our commercial department.

In actual worth, the commercial cooking business that PP&L has built in 5 short years is now valued at well over $1,000,000 annually.

We believe this record can be duplicated with minimum investment by many utilities. Details of our own program are related in the column at the right by Ed Werley, our commercial sales manager.

With the addition of one man, this program was accomplished with our regular field force. This organization was already in contact with the commercial and institutional market in our area—and it was necessary only to direct their attention and emphasis toward the lucrative and untapped cooking load.

In all probability, a similar opportunity exists in many other utility territories.

Hotpoint ALL-ELECTRIC Commercial Cooking

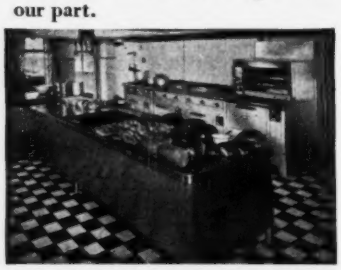
HOTPOINT CO. A DIVISION OF GENERAL ELECTRIC COMPANY

"HERE'S HOW WE ADDED A MONEY-MAKING 12,776 KW's IN ONE YEAR,"

says E. P. Werley, Commercial Sales Manager

"IT STARTED WITH 10 HOTPOINT FRY KETTLES which PP&L purchased as demonstrators. That gave real impetus to our commercial cooking business, and we added Nick Patnay as cooking supervisor. Every time one of our commercial representatives promotes the sale of one of these $100 counter-size kettles, we estimate an annual revenue of $90 from that piece of equipment.

"NOW WE KEEP A COMMERCIAL COOKING DISPLAY IN 24 OF OUR DISTRICT OFFICES. We've found that displays in all of our stores excited interest and brought in profitable business without much effort or expense on our part.



"IN 5 YEARS WE SOLD 432 COMPLETE ELECTRIC KITCHENS LIKE THIS ONE AT MERCY HOSPITAL IN WILKES BARRE. Demonstrations helped us do the job. All in all, our commercial cooking program has added over 10,000 KW's per year, and we're looking forward to even bigger, better loads in the future."

☆ ☆ ☆

You've read the success story of the Pennsylvania Power & Light Company and Commercial Cooking. We can help you write one like it for yourself. Just send me a letter indicating your interest.

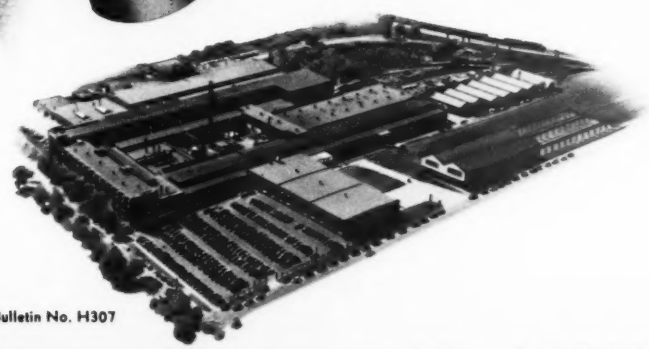
Orrin E. Wolf

Orrin E. Wolf, Vice President
Hotpoint Co.
Commercial Equipment Dept.
265 South Sealey Avenue
Chicago 12, Illinois

MOLONEY ELECTRIC

HiperCore

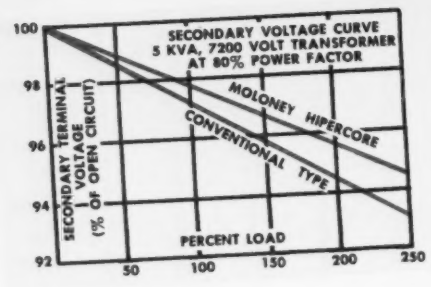
CONVENTIONAL AND CSP DISTRIBUTION TRANSFORMERS



Bulletin No. H307

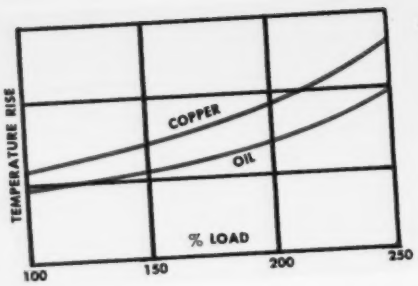
MOLONEY ELECTRIC COMPANY • ST. LOUIS 20, MO.

PLUS CAPACITY



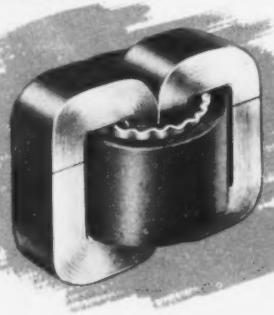
BETTER VOLTAGE REGULATION

Voltage Regulation is an ever-present operating problem. Peak load and off-peak load conditions must all be handled with minimum installed capacity. The smaller cores of HiperCore Transformers make possible windings having lower impedance. Lower impedance provides lower voltage drop at all loads. Improved voltage regulation is the result.



HIGH SHORT TIME OVERLOAD CAPACITY

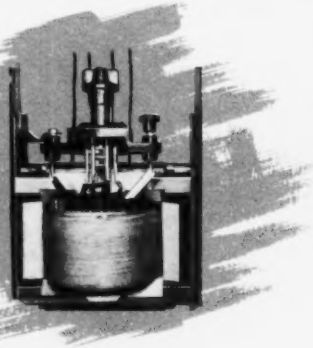
When excessive overload conditions exist, for economical operation of distribution transformer installations, Moloney HiperCore Transformers show to advantage. These overloads may be of several hours duration and tend to shorten the life of the transformer due to the deteriorating effect of high winding insulation temperatures. HiperCore Transformers maintain a lower hottest-spot-over-oil temperature and thus reduce the deteriorating effects such operating conditions impose on winding insulation.



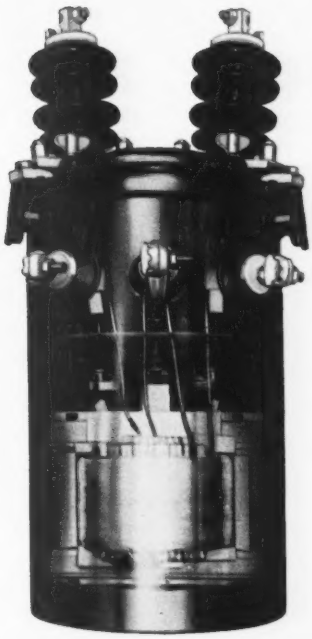
Cores are wound, annealed, impregnated and then cut into U shaped pairs. Matching pieces are then placed in position around the coil to complete the magnetic circuit.

Coils made mechanically rigid through the use of heat curing bonding material, are blocked solidly by the impregnated core which is in turn cemented and then banded with tons of force, providing maximum strength against short circuit forces.

Moloney HiperCore design most effectively takes advantage of the high permeability of cold rolled oriented grain silicon steel. This smaller, more efficient core-and-coil unit makes possible a much smaller and lighter transformer than any other method of construction. Compactness and lighter weight result in greater ease of handling, storing and installing.



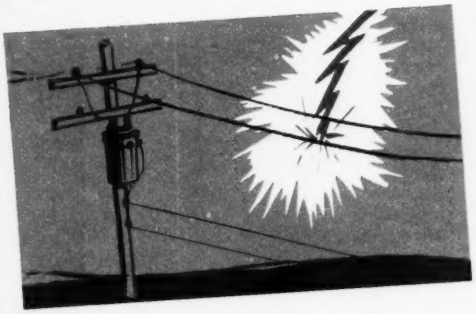
HiperCore TRANSFORMERS



Moloney HiperCore Distribution Transformers are engineered and fabricated with operating features designed to provide better system stability. Severe overvoltages, due to switching or lightning surges, excessive prolonged overload conditions and high ambient temperature, do much to shorten the effective operating life of ordinary transformers and, of course, increase the instances of necessary replacement. Moloney Engineers had all these conditions in mind when they designed the HiperCore Transformer. There is "plus capacity" built into every HiperCore Transformer by which it is better enabled to withstand severe operating conditions. This "plus capacity" permits operation under excessive load conditions without sacrificing system efficiency.

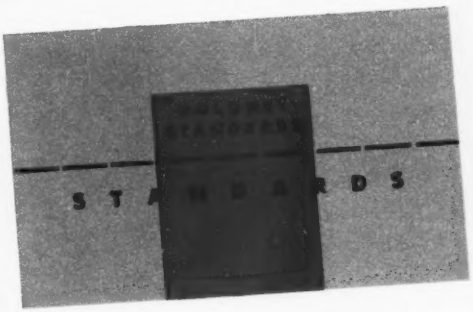
To produce such a superior transformer, experience and proved ability, plus proper facilities, are necessary. Moloney has integrated these factors into one of the finest plants anywhere. And because of this, the following operating advantages are found in every HiperCore Transformer.

ME53-20



HIGH SURGE INSULATION STRENGTH

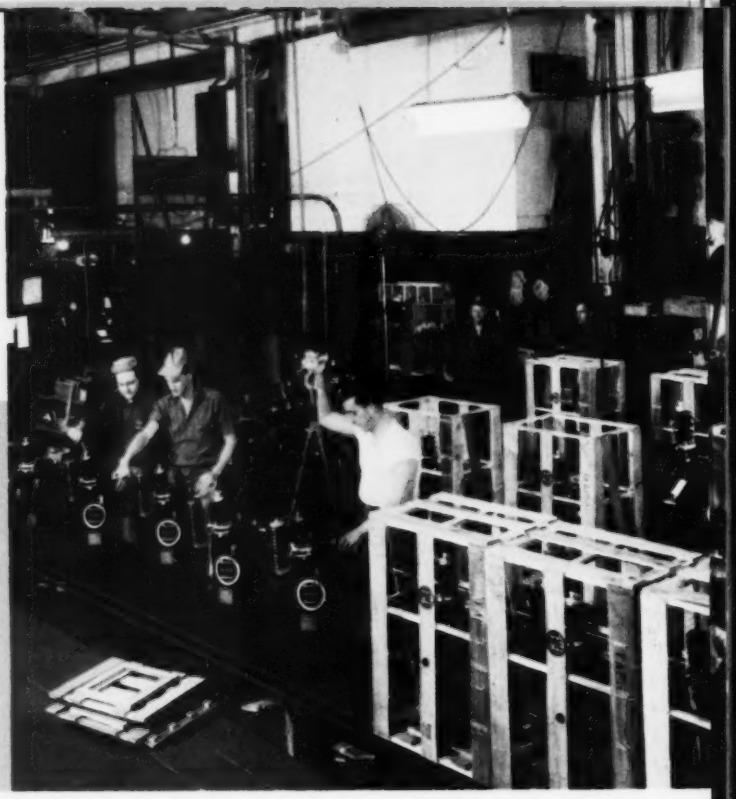
HiperCore Transformers, because of their "Surge-Proved" design, are highly resistant to the effects of switching and lightning surges. Exhaustive surge tests and years of design experience have enabled Moloney Engineers to develop a uniformly high insulation level throughout the entire HiperCore Transformer. This design has been proved by many years of successful operation.

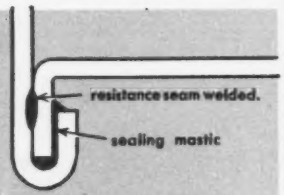


HIGH FACTOR-OF-SAFETY IN DESIGN

Moloney's years of experience in the exclusive manufacture of transformers provide an enviable background which enables their engineers to design into the product a PLUS factor-of-safety. It has been a Moloney policy, which has proved mutually beneficial to both user and manufacturer to maintain a high factor-of-safety in the design of the HiperCore Transformer.

HiperCore Plus Features



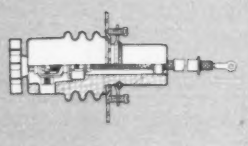


WELDED AND ROLLED LIP ON TANK BASE

Tank base is pressed into tank shell and resistance seam welded. A sealing mastic compound is applied and the extending portion of the tank base is rolled in to provide triple protection against mechanical abuse.

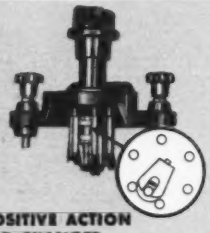
TANK FINISH

Tanks are spray-painted, after thorough sand blasting, with an alkyd melamine paint especially developed for Moloney Transformers. Each coat of paint is baked on. Resultant protective surface is durable, withstands chipping, scraping, and is highly weather resistant.



HIGH VOLTAGE SIDEWALL BUSHING

Moloney sidewall mounted bushings suitable for working "hot" with a molded high impact resistant phenolic — cold rubber protective cap.

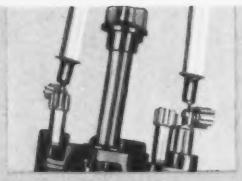


POSITIVE ACTION TAP CHANGER

Double-moving contacts snap into position with a wiping action that assures positive contact. Moloney has for over 15 years placed the tap changer handle above the hot-oil level.

All Moloney HiperCore Distribution Transformers, in addition to superior operating characteristics, have *plus features* and details of construction which add greatly to their dependability and longer trouble-free operating life.

Illustrated and described are a few of the reasons why more and more operators are specifying HiperCore Transformers for their distribution systems.

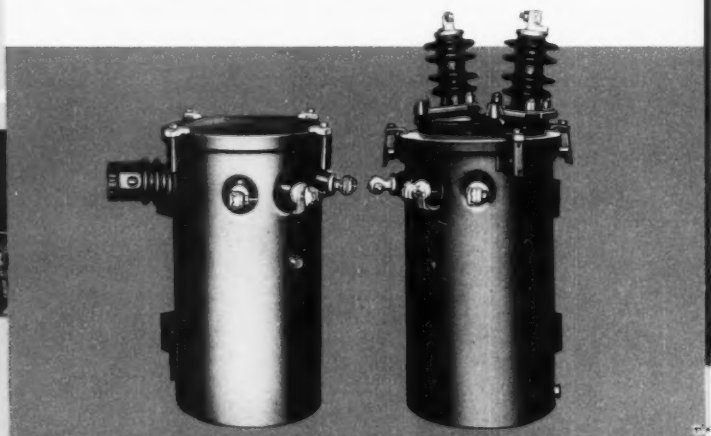


FUSE ASSEMBLY FOR PROTECTIVE EQUIPPED TRANSFORMERS

Internally mounted protective fuse links are accessible through handhole, can be changed without tools and are keyed to assure proper assembly and facilitate replacement without danger of parts dropping into tank.

PRESSURE TESTED TANKS

All Moloney Transformer Tanks are individually pressure tested for leaks in a special spray machine before painting.



Moloney HiperCore Distribution Transformers are available from stock in all standard ratings from 3 Kva up in both Conventional and CSP designs.

LITHO IN U. S

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Electrical Industry In Recession and Recovery

In this issue of Electrical World we are pleased to present our view of the outlook for the American economy and the electrical industry for the next ten years. The estimates and predictions are entirely our own. They differ in some respects from industry forecasts of others, but we find that on the average they are close to ours.

We believe our forecasts are just as accurate as the economic and statistical data upon which they are based. In the economic data prepared by McGraw-Hill Department of Economics, we have great confidence. The recession that is predicted is of a minor nature, not sufficient to upset materially the purchase of electrical equipment and appliances. For this same reason, the recession will not be of sufficient depth to slow up to any great extent the annual increase in use of electrical energy in the home, farm, factory, and store.

We predict good years for the electrical industry in 1954 and 1955 during a period of decline in the total business transacted for the country as a whole. There will be a slowing up in the unusual growth trend but there is little evidence of difficulties that seriously affect earnings and employment in the industry. This statement does not apply to the more cyclic appliance manufacturing and selling agencies.

Looking beyond 1955, we find elements in the economy and population growth that will again accelerate the growth of the electrical industry. As it happens, there is almost enough inertia in the short term outlook to carry over this two-year period.

There is ample evidence that for the next ten years the industry will more than double in size and output.

The period immediately ahead was given special consideration in view of the predicted recession. We believe that we have a major responsibility in collecting all of the pertinent facts which will contribute to a clearer view of this uncertain period.

We have gone beyond our own organization to give our readers other views on the outlook. The effect of a recession upon the earnings of electric utilities is covered in an exhaustive manner by C. P. Guercken, assistant to the financial vice president, Ebasco Services, Inc, in an article entitled "Utility Earnings Will Be Maintained in the Next Recession". Principal factors of interest to investors are covered by T. W. Locke, Goodbody & Co, in an article entitled "Market Outlook for Electric Utility Common Stocks."

It is our hope that this editorial service will be of value to those planning ahead for the electrical industry. It is believed that sufficient evidence is presented to show that the coming recession will not cause a major disturbance in the utility and power equipment manufacturing segments of the industry. But in any event, we commend this material to you and solicit your comments.

Curtis W. McGraw 1895-1953

Those who know Electrical World have known Curtis McGraw, president and chairman of the board of our company, without perhaps ever meeting him or even hearing his name. They have known him through the magazine itself. The enduring mark of his leadership in the great task of keeping the electrical business well informed, shaping the technical development of the industry, and holding the nation to an awareness of its power for greatness and goodness must remain on our pages. It is something lost from the lives of all of us that he died this month.

Friendliness was the distinguishing characteristic of Curtis. He radiated friendliness throughout the whole McGraw-Hill organization and none could help but feel it and pass it on. Emerson said, "The only way to have a friend is to be one." Curtis knew this instinctively, and he lived it, giving us on Electrical World much to keep for long after the sound of his departing feet has died away.

No Time For Complacency

Our attention has been called to the fact that there is a feeling of complacency within the electric utility industry regarding the threat of federal power. It appears that this feeling, if it does exist, has grown out of the change in the administration of our national government and the more favorable political atmosphere and attitude toward free enterprise principals. More recently it appears that this feeling of complacency has become stronger due to misconceptions as to the potential changes in government attitude reflected in the recent power policy statement.

As stated in our editorial entitled "No Real Change In Power Policy" (Aug. 31, p 6), we do not believe that sufficient change has taken place to justify a let-down in industry activities to protect the existence of the power companies. We do believe that this power policy statement reflects an important shift in governmental thinking and policies which can, through further changes and interpretation of the law, make a major difference in the final result. But a final, satisfactory, solution to the problem will require not only a continuation but an acceleration of industry activities directed towards this end. We agree with Robert E. Ginna, chairman of the Electric Companies Public Information program, who called for an intensification of information activities. He said, "An informed public opinion on both the national and local level will now be more vital than ever to strengthen the hands of those who have the power and the will to implement the wishes of the people by their acts and influence."

Those who guide and hold the destinies of private enterprise in the industry must look not to the Republicans or to the Democrats for support. They must look to the people. They must keep all Americans informed of the stake they have in private enterprise in all industries.

Wholesale Generation Not "Unique"

In recent negotiations, leading to a wage arbitration board award applicable to employees of the Montaup Electric Co, the union claimed that comparison with other utilities was a highly limited criterion. Montaup is a wholesaling producer company serving affiliated retail utilities in Massachusetts and Rhode Island. The energy is generated at a large and efficient steam plant at Somerset, Mass. It is transmitted to the recipients at a maximum potential of 115 kv. The union contention was that this was "unique." They implied that the neighboring wage adjustments should have little bearing on the arbitration proceedings.

The board gave great attention in its ponderings to this statement of the union representative. It concluded, however, that whatever "uniqueness" Montaup possessed was to be found only in the fields of finance and corporate arrangement. It could find nothing so singular about the operations of the 190,000-kw steam generating station at Somerset that the duties of its producing employees could be called "unique".

Operations there follow the same principles as in other New England generating plants utilizing fuel. Whatever dissimilarity there might be on operational levels the board found to be normal between any two manufacturing units in similar fields of business. Nor did it find any indication that any considerable change in the company's fiscal or financial set-up would have any effect on production or employees' duties. In a word, it said, no technological diversities appear to exist which would warrant wage differentials betwen Montaup and other regional plants based on Montaup Electric Co's wholesaling functions. This view seems to have been both logical and appropriate.

THE ELECTRICAL WEEK

The Issue's News Highlights—Tests on BPA's new type of 345-kv single-circuit transmission tower are being conducted by Bethlehem Pacific Coast Steel Corp . . . Ellis told regional meeting of NRECA co-ops have many problems to worry about and traced some of them to shifts in federal government's power policy.

FPC Examiner Costello delays hearings on Hells Canyon to Sept. 28 at request of proponents of a federal dam . . . Sen Wayne Morse will give talks on federal power policy for National Hells Canyon Association.

Atomic Industrial Forum, an association incorporated last April to encourage use of nuclear energy for peaceful purposes, becomes an operating entity today with the announcement that Charles E. Robbins, former vice president of Bozell & Jacobs, Inc, has been named executive manager. AIF, headed by Walker Cisler, president of Detroit Edison, has appointed Oliver Townsend, formerly assistant to the chairman of AEC, assistant executive manager. AIF will set up permanent headquarters in New York the first of next month.

B&J, which handles the Public Information Program, today announced that Gordon R. Molesworth, in charge of public relations for AEC's Oak Ridge operations, will succeed Robbins Oct. 1, handling the agency's Nuclear Energy Information Division.

Power distributors in the Western Missouri Basin Area now will be able to negotiate 20-year contracts for power from Bureau of Reclamation projects without resale conditions imposed by the federal government. This provision is part of new criteria for power marketing announced for the area by Interior, which is also developing criteria for projects along the main stem of the Missouri.

First Prize in "My Most Interesting Lighting Job" contest of Illuminating Engineering Society went last week to Merrill Humber, Humber & Walker Co, for his job, "Lighting the Broadway Tunnel in San Francisco." Award was made at IES National Technical Conference in New York. Among new developments unveiled there was the first 1550-w infra-red lamp to be used as a top burner on an electric range.

Rhode Island's Governor Roberts has asked electric utilities in his state to analyze their costs and try to reduce rates as an incentive to bring in new industries.

Private Citizen Harry Truman at the $100-a-Plate Democratic Dinner last week in Chicago was lambasting the Republicans on a familiar issue: "They say they (the Republicans) want to develop our natural resources for the people, but they are doing their level best to give away Hells Canyon and Niagara Falls to the power trust."

Next day, as if in reply, Interior Secretary Douglas McKay told a Washington audience, "As much of the future power development of the country as can be financed with local money, . . . should be so financed." He added it was not Interior's "primary obligation to engage in the power business as such, or to assume responsibility therefore."

The nation's second atomic-powered submarine, the Sea Wolf, got its start last week in Groton, Conn., when its keel was laid by Navy Secretary Robert B. Anderson. It will be powered by an "intermediate neutron reactor" being built by GE at Schenectady. The first atomic sub, the Nautilus, is nearing completion on nearby ways. Its reactor, of a different principle, is being built by Westinghouse in Idaho. The Navy now is planning a third such sub.

A mountain slide involving a million yards of mud and rock hit the new Whatshan Power Plant of British Columbia Power Commission last week, knocking it out of operation for several months. To replace the plant's 33,000 hp, the commission is borrowing power from West Kootenay Power Co.

First work stoppage at EEInc's Joppa Plant since Bechtel took over from Ebasco occurred Tuesday, when a dispute arose over interpretation of a contract with the ironworkers.

New York State Power Commission has been given another 60 days in which to accept a license granted by FPC for construction of the U. S. half of the $600 million St. Lawrence Power Project. If no court action is filed against the license in that time the Authority will be free to accept it without further threat of litigation.

Northern Lights, Inc, an REA-financed system at Sandpoint, Idaho, has asked FPC for preliminary approval of plans for a 9,000 hp, two-dam hydro project on Priest River and Priest Lake in Bonner County.

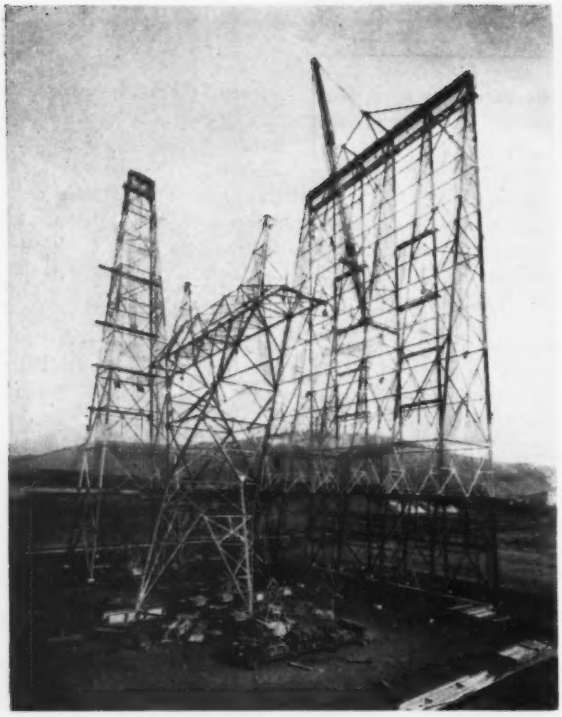
Grand Coulee Dam broke its own world's record for power production Sept. 9, when a full reservoir and low water at the base permitted the two powerhouses to generate 2,234,000 kw for a single hour, and 52,780,000 kwhr over a 24-hour period.

Contour corners have hit the electric blanket market. General Electric Co last week came up with a model with bottom corners contoured in mattress-fitting fashion.

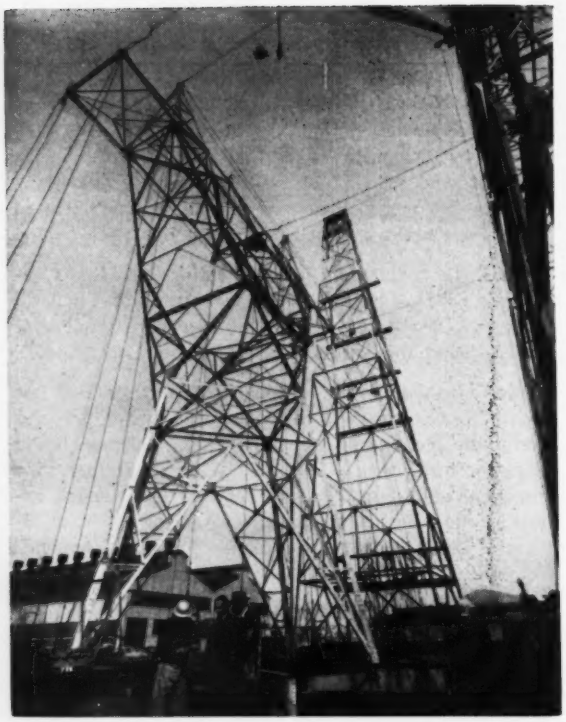
REA rural consumer No. 4,000,000 was added to administration-financed systems last week. In making the announcement, Administrator Ancher Nelsen said the thousand systems are adding customers at a rate of 20,000 a month.

Financial—Merger of Pennsylvania Electric and Northern Pennsylvania Power, GPU subsidiaries, has been approved by PUC . . . Estimates put Consolidated Edison's net this year at about $3.10 a share. Last year's net was $2.63 . . . Iowa Electric L&P has filed registration statement with SEC covering proposed offering of 230,000 shares of common. Offering should bring in about $4.5 million.

Congratulations—Elliott Co elects three commercial vice presidents: H. S. Pahren, W. E. Widau, and J. H. Strickler . . . James F. Magin, assistant to the general manager of Square D Co's Milwaukee plant, is appointed a vice president of the company.



TEST TOWER INSTALLATION of Bethlehem Pacific Coast Steel is ready for application of test loads on new type of 345-kv single-circuit transmission tower Bonneville Power Administration plans to erect



HORIZONTAL CABLES strung from the test tower to the testing frames exert a pull to represent the weight and tension of conductor wires or the pressure of the wind on the conductor wire transmission

BPA's New Tower Is Put to the Test

Equipment for 345-kv line is thoroughly checked by Bethlehem Pacific Coast Steel

Tests of a new type of 345-kv single-circuit transmission tower are being completed by Bethlehem Pacific Coast Steel Corp., which will fabricate 1,050 of the towers for installation on Bonneville Power Administration's McNary-Ross and Foster Creek-Snohomish power lines in the Pacific Northwest.

The new tower, first of its kind to be manufactured in this country, is a dead-end, heavy-angle type. Before final approval of the design, Bethlehem Pacific's Transmission Tower Fabricating Division tested to destruction a prototype on its new 160-ft high steel tower testing frames in South San Francisco.

Testing Equipment . . . The testing equipment consists of concrete foundations with projecting steel angles which provide a rigid base for mounting towers of varying widths, and two towers, over which sheaves are suspended and the load pulling cables are passed. Chain blocks are used for applying all loads except vertical ones, which are applied with dead weights of steel billets or zinc slabs. The tower reacts to the pull of the chain block, and since it is elastic it maintains the load when the pull on the chain block is discontinued. Failure of any member instantly increases the tower deflection, which in turn decreases the tension in the pulling cables, thus constituting an important safety feature.

Careful Examination . . . After all tests are successfully completed, the tower is dismantled and members are examined for signs of having been overstressed in compression or tension.

Undamaged members of the test tower are used in building towers of the transmission line.

The tower testing has several functions. It verifies or corrects the tower design and the shop detail drawings from which subsequent towers are to be made. It checks the shop templates. And it shows designers how difficult the tower is to construct and how long it will take to erect it in the field. Towers cannot be designed to the maximum weight possible unless a full size tower is built and tested to destruction to determine whether the design must be strengthened or whether there can be a reduction in weight.

Bethlehem Pacific's steel test towers were installed in 1950, replacing wooden ones. There is only one similar test tower installation in the United States—in Pittsburgh, Pa.

Co-ops Face Tough Hoeing . . .

. . . NRECA head Clyde Ellis tells regional meeting. Ancher Nelsen outlines and defends policies of new Administration

The nation's rural electric cooperatives have more than a fair share of problems to worry about, in the opinion of Clyde T. Ellis, executive manager of the National Rural Electric Cooperative Association.

Summing up these problems in Mackinac Island, Mich., at the first of the organization's ten regional meetings, he said:

"We have known for several years that the general climate for our program has been worsening, as a result of the most gigantic, multi-million dollar propaganda and lobbying campaign that has ever been launched within these United States.

"Those who oppose us seem to have now taken full advantage of the change in administration in order to move in quickly, sometimes in the hope of exploiting power resources for their own gain and to our detriment; sometimes merely to kill off parts of our program even when the result would not substantially benefit them."

Federal Changes Emphasized . . . Ellis traced a good deal of co-op troubles to the changing tenor of the federal government's power policy.

"It seems apparent," he said, "that the heretofore dynamic federal program of developing the country's rich hydroelectric resources and selling that power in such a way that the people get the benefits is going down the drain, one license and one contract at a time."

He cited several specific cases:

- Repudiation of contracts for integration of power cooperative systems in Oklahoma, Missouri and Arkansas with the Southwestern Power Administration's hydro system, brought about by Congressional refusal "to authorize any further continuing fund to carry out the agreements during fiscal 1954."
- The wiping out of construction funds to facilitate delivery of hydro power by the Southeastern Power Administration to the load centers of preference customers.
- Deletion by the new Administration of $30 million from the Tennessee Valley Authority appropriation, which was earmarked to start construction of two initial units at the Fulton Steam Plant above Memphis.
- Slashes in construction funds of the Corps of Engineers that will eliminate continuing work on the Detroit Dam in Oregon and the Table Rock Dam on the Arkansas-Missouri border.
- Indication that the Idaho Power Co will get its license to build three small dams on the Snake River in Idaho, to take the place of the federally proposed Hells Canyon Dam
- Elimination of the preference provision in a license granted to the state of New York to build and operate the St. Lawrence power development.

Other Problems Listed . . . Ellis warned his Region IV listeners to keep their eyes on several other matters. Among them: atomic energy, tax amortization certificates for utilities, and the new Hoover Commission.

On the atomic energy score, he said: "It is the NRECA board's conviction that atomic discoveries and patents should remain part of the public domain, available to all the people; that they should not become the property of a privileged-corporation few, nor should the few be permitted to levy tolls upon electric consumers through the use of patent monopolies."

Ellis urged the cooperatives to press Federal Power Commission and state utility commissions to compel the private power companies to pass on the entire benefits of tax amortization certificates in the form of proportional lowered rates. He pointed out that only the Georgia commission has required that the rate base be reduced by an amount equal to the surplus or tax reserve.

The NRECA head also cautioned against the new Hoover Commission. Ellis emphasized that "Mr. Hoover and his old commission are on record . . . as favoring the reorganization of REA" and that "Mr. Hoover is also on record publicly as favoring the withdrawal of the federal government from the power field and the sale of falling water at the dams to those in a position to purchase it for generation and transmission."

CLYDE ELLIS, left, welcomes Ancher Nelsen to latter's first NRECA meeting as REA head

Nelsen Speaks First Time . . . Speaking before an NRECA meeting for the first time, REA Administrator Ancher Nelsen said REA's biggest job is to help maintain the economic stability of the country "so that co-op properties are not sold on the auction block at 10 cents on the dollar."

Reviewing the agency's policy since the new Administration took over, Nelsen said:

"We have taken steps to establish in REA the belief that the job of extending adequate electric . . . service can be most speedily and effectively accomplished through industry-wide cooperation with various public agencies and private companies that are active in these fields. If existing private companies are willing and able to aid in these endeavors, we will welcome their help because this will reduce the need for government loan funds and enable us to operate more economically."

Nelsen emphasized that REA is endeavoring to eliminate those functions and activities which are not directly related to loan security.

"We are doing this," he said, "in the interest of economy as well as to encourage borrowers to rely on their own endeavors and to avoid government interference with private affairs."

He defended the recently announced power policy of the Department of Interior by stating that it assures the cooperatives that as in the past government development will continue to have a place in the nation's power picture.

"You are further assured that adequate transmission facilities will be available so that you may be able to tap this source of power, and you are assured that the preference clause will continue—guaranteeing the cooperatives their share of hydro power."

REA Policy Rapped . . . One of the major resolutions adopted by the delegates took a swipe at current REA procedures.

The resolution charged that "there now appears to be a tendency to alter, modify or change the policies of the REA in such a way as to give greater encouragement to the development of electric utilities at the expense of cooperatives."

Formation of a committee was called for to discuss the matter with the President and high officials with duties relating to the development of electric service.

Hells Canyon Hearings Postponed Until Sept. 28

Federal Power Commission hearings on the Hells Canyon application of Idaho Power Co, scheduled to open today, have been postponed to Sept. 28.

Late last week the commission's examiner, William J. Costello, granted opponents of the utility company's plan a one-week delay.

National Hells Canyon Association, which has been spearheading the fight against Idaho Power's low-dam proposal, had previously applied to the full commission for a change in hearing procedure which would permit extending recess until Nov. 9—or, alternatively, Oct. 12. Specifically, NCHA lawyers said they needed the extra time to consult Interior Department and Army Engineers officials, and dig out data in those two agencies.

FPC, in turning down the request, also ruled against alternative motions —that Interior and Engineer witnesses be presented for direct examination next, before Idaho Power witnesses come up for cross-examination; and that the deadline be extended to Oct. 12 to give time to prepare for cross-examination of company witnesses.

The commission, in turning down these pleas, noted that "any motion for an extension of the recess" fixed by Examiner William J. Costello "should have been addressed to him in the first instance."

Late last week the NHCA did just that—applied to Costello for a delay to Oct. 12. He granted only one of the three weeks asked.

Laying Foundation for Mine-Mouth Plant

Foundation work for Utah Power & Light Co's mine-mouth generating plant at Castlegate, Carbon County, Utah, is nearly completed. Photo shows positions being plotted for foundation of main building. Newly poured footings for turbine bays can be seen at right.

The 66,000-kw plant is scheduled to utilize 750 tons of coal daily, with the fuel brought directly to the plant by conveyor systems from the entry of a nearby bituminous coal mine. The station will cost $10.5 million and is scheduled to begin operations late in 1954.

Morse to Speak

NHCA recruits senator for four talks in the Northwest on Administration power policy

National Hells Canyon Association has recruited Oregon's Sen Wayne L. Morse for a series of four speaking appearances in the Pacific Northwest this month to discuss the Eisenhower Administration's power policy.

At the same time, NHCA's President James T. Marr reported association representatives will meet with Assistant Secretary of the Interior Fred G. Aandahl and representatives of the Army Corps of Engineers in Washington "to explore the possibility of a partnership between the federal government and local interests" for construction of multipurpose dams in the Columbia River basin.

Interior Proposed Meeting . . . Marr reports Aandahl offered to meet with the association, which advocates a large hydroelectric dam in Hells Canyon of the Snake River as opposed to the Idaho Power Co's three-dam proposal, after a telegram the association sent to President Eisenhower following announcement of the Administration's power policy by Undersecretary of the Interior Ralph A. Tudor. Marr added, that in reply to Aandahl's letter, the association has asked "what plans are under way for sponsoring enabling legislation" and "what proposals the department has evolved" to implement the power policy pronouncement. Marr said this information is sought as background information for the meeting at the nation's capital.

Senator Morse doubtless will attack the power policy along lines he already has expressed. His four appearances are the first in his home state since he leveled oratorical guns at Secretary of Interior Douglas McKay at an Oregon Democratic party-sponsored dinner in which the Snake River controversy was the dominant topic.

The Oregon senator, ex-Republican now a self-proclaimed Independent, will open his series in Boise, Idaho, Sept. 24; will speak in Baker, Ore., and Joseph, Ore., cities near the canyon site in eastern Oregon, the same day. His Portland talk is scheduled for Sept. 25 at Reed College where officials said Morse would speak to a student assembly.

"LIGHT'S DIAMOND JUBILEE" will be symbolized by this emblem. To represent electrical progress both past and future, Edison's lamp was depicted against the atomic symbol. Slogan chosen for the year-long 1954 celebration was "Light for Freedom—Power for Progress"

Pick 'Jubilee' Emblem, Theme

Plans are being made to celebrate Light's Diamond Jubilee next year in 400 cities and towns throughout the country to mark the 75th anniversary of the invention of the first practical incandescent lamp by Thomas Alva Edison.

This was announced last week by George H. Blake, president of Public Service Electric & Gas Co and chairman of the planning group of the Jubilee Committee.

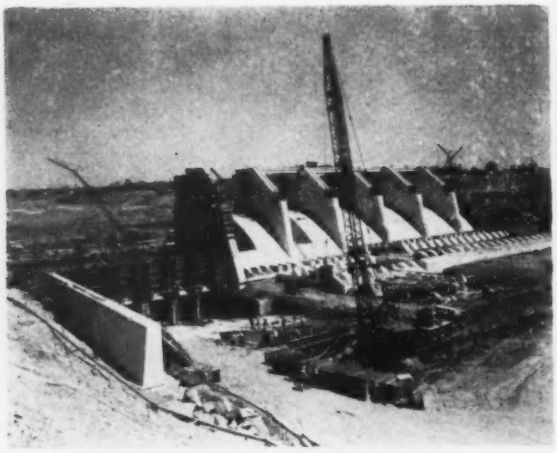
Blake said nationwide observances by the industry would culminate on Oct. 21, 1954, the anniversary date. First celebration probably will be that in Atlantic City during next year's Edison Electric Institute convention. Simultaneous celebration of Light's Diamond Jubilee and Atlantic City Centennial is scheduled to begin in June.

The Theme . . . Jubilee theme, according to Blake, will be electrical progress, past and future (see emblem, above). "Edison's lamp of 1879," he said, "was the appliance for which Edison developed a complete system for the generation, distribution and metering of electricity to make it more practical for general use."

The invention was the result of Edison's search for an electric light that would be practical for mass use and an improvement on gas lamps of the day. His experiments in 1878 and 1879 ended successfully on Oct. 21, 1879, when he found a lamp filament that would endure the intense heat necessary to provide light.

The inventor was working concurrently on a system for generation and distribution of electricity to make the lamp usable on a mass basis. This system was used for the first time Dec. 31, 1879, when homes in the village of Menlo Park, N. J. were lighted by the new lamps.

Expanding . . . The Jubilee Committee is being expanded, Blake said, and full membership will be announced shortly. Present members include, beside the Public Service president, Ralph J. Cordiner, president of General Electric Co; Bayard L. England, president of Atlantic City Electric Co and last year's EEI president; P. H. Powers, president of West Penn Power Co; Gwilym A. Price, president of Westinghouse Electric Corp; and Justin R. Whiting, president, Association of Edison Illuminating Companies.



USBR Projects Are Rising on the American River

Two hydroelectric projects being constructed by Bureau of Reclamation on the American River in California are expected to be in operation by the end of next year. Pictured at left is Nimbus Dam with power plant on the left and spillway section on right. In photo at right Folsom power plant view is shown looking upstream through the excavation floor which is 365 ft below crest of the dam.

The Nimbus project will have a capacity of 13,500 kw and the Folsom project 162,000 kw in three units.

Nimbus Dam is 15 miles east of Sacramento and will serve as an afterbay for regulation of water released from Folsom Dam 7 miles upstream.

Moses Urges TVA Be Run on Business Basis

Charging that Tennessee Valley Authority is a tax-subsidized burden on the rest of the nation, C. Hamilton Moses, chairman of the board of Arkansas Power & Light Co, recently urged that the authority's power operations be put on the same basis as the business-run electric companies.

Speaking before the Council of State Chambers of Commerce at Hot Springs, Moses asserted that it is misleading to say TVA is paying its own way like any other industry. He noted that in 1952 TVA payments in lieu of taxes amounted to 3.2% of gross revenues. Private companies, Moses said, paid about 22½% of their gross revenues in taxes.

If TVA had to pay taxes on the same basis as private utilities, but getting money at the government rate of 3½%, the agency in 1952 alone would have shown a loss of $12 million, he contended.

Operating TVA on same basis as a private utility, Moses said, would mean that TVA would:

- "Pay taxes on the same basis as are paid by the non-government producing enterprises.
- "Pay annually the interest on the money invested in power facilities at the cost of that money to the government. An alternative would be for TVA to sell its own revenue bonds.
- "Keep its books and report to Congress on the same basis as the federal and state regulatory agencies require of the investor-owner utilities."

Operating TVA in such a manner, the Arkansas P&L chairman declared, would be fair to the taxpayer, consumer, and citizen alike and would not give TVA states an advantage in attracting new industries.

Moses admitted such operation would mean higher TVA rates, but he said "the cost of taxes and interest on money equal almost half the cost of electricity."

Utah P&L Completes Line To Uranium Boom Town

Utah Power & Light Co has completed a new 31-mile long, 44-kv line to Moab in southeastern Utah, scene of a uranium mining boom of considerable proportions.

The new line taps U P&L's 130-kv system at Crescent Junction. Power enters the community at a new 600-kw substation. Total cost of new facilities was $144,000.

Alabama Bill Provides for Operating TVA Plants

A bill has been introduced in the Alabama legislature providing for the acquisition and operation of Tennessee Valley Authority facilities in the event they are disposed of by the federal government.

The bill, in the form of an amendment to the state constitution, provides for the formation of a "Tennessee Valley Development Corporation" composed of one member from each of the counties in the state through which the Tennessee River flows and one from the state at large. Members of this board would be appointed by the governor to serve for terms of four years.

The board would have the power to acquire TVA facilities in Alabama disposed of by the federal government and to maintain, operate, and repair them for the state in accordance with any conditions set by the U. S. Congress or the state legislature.

Other items in the week's news will be found starting on page 268.

Eastlake Plant Goes on the Line

The first 125,000-kw turbogenerator of Cleveland Electric Illuminating Co's new Eastlake Plant (above) went into operation late last week. The $125-million plant is located in Eastlake, Lake County, on the shore of Lake Erie near the mouth of the Chagrin River, 200 miles from downtown Cleveland.

A second 125,000-kw unit will be in operation at the plant late in November, and a third of similar size will follow in the spring of 1954. By 1955 CEI expects to put the fourth unit into service. This 208,000-kw turbogenerator will boost operating capacity of the Eastlake Plant to 583,000 kw. CEI system capacity then will be 1,727,000 kw.

U. S. Agency Allotted Funds for Fish Study

The U. S. Fish and Wildlife Service has received an $80,000 allotment from the Corps of Engineers to begin a three-year program of electrical fish guidance research in connection with the problem of passing fish over dams, according to an announcement at Seattle, by Clinton E. Atkinson, chief of Pacific Salmon Investigations for the Fish and Wildlife Service. A total of $228,000 has been allotted for the three-year program.

Laboratory experiments have been conducted at Seattle for the past year to determine the reaction of fish to electrical current patterns, with the resulant discovery of the lethal limits of electrical current for two species. Under the new program, fisheries biologists plan to carry out field experiments, first in several tributaries of the Columbia River. Stream bed conductivity will be tested and studies conducted to establish the most effective electrical fields under actual stream conditions.

Experiments have proved that young fish can be guided by pulsating direct current away from the churning turbine wheels of hydroelectric dams that presently destroy many fingerlings on their way downstream to the ocean.

Budget Adopted by PUD

The Cowlitz County PUD of Longview, Wash., has adopted a preliminary budget of $3,630,000 for 1954, including $660,000 for construction. Construction will include three $100,000 substations; transmission lines to the new substations, $50,000; a power link with the Clark County PUD system, $50,000; and purchase of two large transformers, $30,000 each.

POWER BRIEFS

- Newfoundland Light & Power Co is undertaking another new hydroelectric power project at Piper's Hole that will have an ultimate capacity of 30,000 hp. The project, which is expected to start production before the end of 1955, will provide power for Bell Island, St. Johns, and other towns in the Avalon peninsula via a 100-mile transmission line.
- Two federal district judges have approved an examiner's recommendation of a price of $1,267,033 for land condemned to make way for the Clark Hill reservoir on the Savannah River. Both the federal government and Twin City Power Co, owner of the 4,707 acres and water power properties in South Carolina and Georgia, have objected to the recommended price for the property.
- Dust coatings on pole insulators caused power outages in nearly every section of the Cowlitz County (Wash.) PUD system when rain hit the area recently. The coatings, built up durin the dry season, served as a conductor when dampened and started fires and resultant outages occurred for an estimated 1,000 customers before crews were able to repair minor damage.
- East and West Germany have resumed exchange of electric power following an 18-month cut off initiated by the Communists. Chief beneficiaries of the exchange will be West Berlin, which will get power from East Berlin, and the East German province of Mecklenburg, which will be supplied with power by West German plants in Hamburg.
- Pacific Gas & Electric Co's power deliveries soared to 3,340,100 kw last year—an all-time peak load and an increase of 8.6% over the 1952 record. PG&E's new yearly peak load virtually doubles the peak wartime load of 1,693,600 kw set in 1945, and triples the 1940 prewar peak of 1,125,700 kw.
- Southwestern Power Administration has reported a gross income of $2,829,553 in the fiscal year ended June 30 for electric power generated by its six federally owned dams in Arkansas, Oklahoma, and Texas. In the preceding year SPA sold $2,635,193 worth of power from three dams in operation at that time. Sales will increase this year as all units were not in full operation.

WASHINGTON COMMENT

WILLIAM B. WHICHARD

Atomic Energy Poses Problems for the Industry

Top management of substantial segments of the electric power industry are squarely up against two tough problems in connection with atomic energy. The problems:

1. What to do about amending the Atomic Energy (McMahon) Act of 1946, which Congressional backers hope to write into law next spring?

2. What should be done about the heavy shroud of secrecy that now envelops the whole world of the atom, including the possible use as a boiler fuel?

Atomic Work or Contractual Basis . . . Private industry already is up to its ears in atomic work. This is especially true of manufacturers of heavy electrical equipment. But this work is handled on a contractual basis for the government. Except that industry thus is gaining essential technical know-how, however, this arrangement is worthless as an avenue toward establishment of private enterprise in the atomic field, either in atomic power or any other line of business. Indeed, the contractual system was designed solely to keep one phase of atomic production—the fabrication of weapons—a federal monopoly.

With the approval, even outright encouragement, of the Atomic Energy Commission, several groups of firms, including many electric utilities, are well along with studies of the feasibility of producing electric power with atomic fuels. From the start, these studies have been aimed at privately owned atomic power plants. But as the law now stands, these studies can't go much beyond the blueprint stages.

This is because the McMahon Act forbids private use and ownership of both materials (atomic fuels) and reactors (atomic furnaces). Chairman W. Sterling Cole and other members of the Joint Congressional Committee on Atomic Energy hope, at a minimum, to lift these restrictions early next year. If they fail, atomic power plants, for private industry, at least, will remain blueprints. You can't test even a mock-up steam plant with neither coal nor a boiler.

Restrictions May Stay . . . And failure to get rid of these basic restrictions is more than a possibility next spring. A number of Congressmen, including some members of the Joint Committee, honestly do not understand why any such change in the McMahon Act should not be postponed for at least another year.

They reason, quite correctly, that the first atomic power plant, not yet even designed, will take two to four years to build, another year or two to test. Not until the testing stage will any fissionable material be required.

This reasoning nicely fits a Congressional mood that was developing rapidly even before the recent adjournment. More and more Congressmen were worrying over their heavy schedule of legislation awaiting their return to Washington next year. With Congressional elections coming up, the legislators want a short session so they can get about their campaigning. So why get into anything as controversial as new atomic energy ground rules unless it's absolutely necessary?

Despite last summer's hearings of the Joint Atomic Committee, industry apparently failed to get across its reasons for an early change in the McMahon Act. Some industry spokesmen—or several—need to get this story across in simple terms.

Experimenting Is Expensive . . . The next phase of atomic power development obviously is the pilot plant, whether it be a small mock-up or a full-scale unit. In either case, the cost to the private enterprisers undertaking such a project will run into the millions of dollars—from upwards of ten millions for a small-scale pilot plant to 100 millions for a unit with a capacity of 150 to 200 Mw.

You don't engage in such dear experimentation when you aren't sure it will be legal to use or own either the plant or the fuel it will require. You can't persuade your board of directors to assign either the cash or the manpower under such circumstances. And you wouldn't waste your time talking to financial sources.

That's what someone from industry must make clear to Congress, and do it before atomic legislation can be bypassed by the Congressional leadership. And it must be done in the face of opposition which already is accusing industry of making a "grab" for atomic power at the expense of the taxpayers.

Problem of Secrecy . . . The secrecy problem is no prettier. There are a number of schemes for letting industry into atomic power development and, at the same time, preserving much of the present cloak-and-dagger screen.

True, private industry has been making weapons for the armed forces since the birth of the Republic and keeping the details adequately safeguarded. It could do so in the atomic power field, but it should first determine if the effort is worthwhile.

There is too much to be gained by starting our atomic power industry with as few secrets as possible, though the final decision on this must come from those responsible for the nation's safety. But industry would do well to demand a minimum of secrecy.

TECHNICAL NOTES

ARCHER E. KNOWLTON

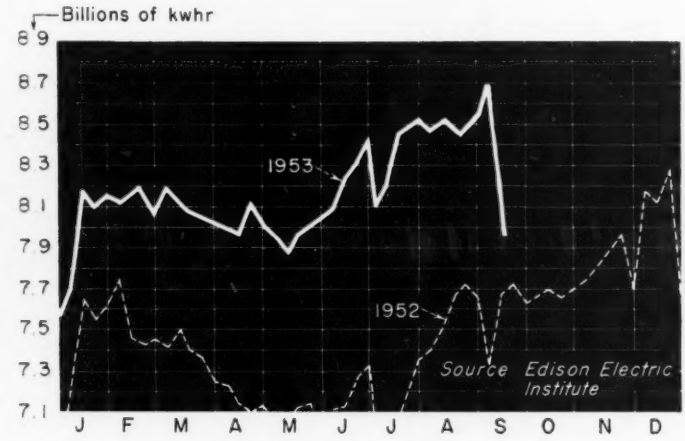
Guy stubs are tempting but dangerous supports for television antennas.

Failure of projects instituted a few years back need not condemn the proposal for all time because new materials and new techniques evolved in the interim might now assure success.

Electro-optical device's (television included) high resolution, high sensitivity, broad response and fidelity usually have to be achieved at the expense of complexity, high cost, uncertain operation, bulkiness and undue maintenance.

Gasoline, completely vaporized and mixed with the right amount of air, has the explosive force of 14½ times as much weight of dynamite.

STATISTICS



Output Week Ended Sept. 12—7,962,823,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Sept. 12	+4.0	—0.1	—1.6	—1.9	+1.1	+16.6	—0.7	+3.7	+15.2	+7.7
Sept. 5	+18.7	+20.9	+18.9	+19.0	+20.4	+28.9	+9.7	+12.2	+12.4	+10.8
Aug. 29	+11.7	+10.8	+10.1	+11.8	+10.4	+25.4	—1.6	+8.6	+5.7	+7.1

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	July	76.6	76.0	67.2
Capacity (Million Kw)	July	86.13	85.06	77.96
Production (Billion Kwhr)	July	38.03	36.83	32.52
Hydro	July	8.75	9.10	8.74
Fuel	July	29.28	27.73	23.78
Fuel Consumption				
Coal (Million Tons)	July	9.59	9.06	7.91
Oil (Million Barrels)	July	6.35	6.12	4.39
Gas (Billion Cu Ft)	July	109.35	103.73	99.46
Sales (Billion Kwhr)	June	31.77	31.32	27.67
Residential	June	8.37	8.50	7.44
Commercial	June	5.46	5.18	5.00
Industrial	June	15.80	15.49	13.20
Other	June	2.14	2.16	2.03
Net Income Class A & B Companies ($ Million)	June	77.81	82.13	71.03
Estimated Dec. '53 Peak (Million Kw)	June	86.2	86.1	88.3
Kwhr per Residential Customer (12 Month Average)	June	2,257	2,241	2,091
Revenue per Kwhr Residential Service (12 Month Average)	June	2.76¢	2.76¢	2.78¢
Canadian Production (Billion Kwhr)	June	5.26	5.76	4.99

Business Statistics

FRB Industrial Production Index†††	July	235*	241	194
Gross National Product Annual Rate ($ Billion)	2nd Qtr.	372.4	362.0	345.1
EW 5 Industry Production Index	July	130.6	130.9	95.6
ENR Construction Cost Index††	Aug.	128.3	126.6	122.7
BLS Consumer's Price Index	July	114.7	114.5	114.1
NEMA Insulation Materials Sales Index†	July	150	174	123
NEMA Electric Appliance Sales Index†	July	86	105	100
NEMA Household Refrig. Sales Index†	July	87	88	100
Metal Prices (Sept. 15)				
Copper, Conn. V., lb.		$ .29-.30	$ .29½	$ .24¼
Lead, N. Y., lb.		.14	.14	.16
Zinc, prime Western E. St. Louis, lb.		.10	.11	.14½
Tin, Straits, qual. N. Y., lb.		.81½	.83	1.21½
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	62.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		40.00-41.00	44.00-45.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

Slight Upward Trend In Average Electric Bills

The average residential bill for 250 kwhr per month was $6.94 on January 1 of this year. The Federal Power Commission reports that this is a 15-cent increase over last year, but represents only a small percentage

Residential Electric Bill 250 Kwhr per Month

	1953	1943
Akron	$6.30	$5.68
Atlanta	6.10	6.57
Baltimore	7.45	7.68
Boston	9.48	9.40
Chicago	6.35	6.65
Cincinnati	5.90	4.75
Dallas	6.87	7.54
Denver	6.00	6.80
Detroit	7.74	6.66
Houston	5.58	5.97
Indianapolis	6.65	6.95
Los Angeles	4.90	5.10
Miami	7.79	7.13
New Orleans	6.83	8.10
New York	8.39	8.13
Philadelphia	6.48	5.85
Pittsburgh	6.95	6.35
Salt Lake City	6.68	7.00
San Francisco	6.44	5.42
Seattle	4.84	5.20
Washington	5.84	4.91

Federal Power Commission

gain over the all-time low levels established in recent years. (In 1925 the average bill was $12.86.) Bills for industrial services showed more substantial gains, while commercial bills decreased slightly.

The average annual residential use of electricity in cities of 50,000 or more population was 1,798 kwhr per

Annual Kwhr Use

	1951	1941
Akron	2,004	1,311
Atlanta	2,402	1,426
Baltimore	1,618	907
Boston	1,113	638
Chicago	1,483	946
Cincinnati	1,610	1,059
Dallas	2,033	993
Denver	1,502	776
Detroit	1,729	1,064
Houston	1,855	940
Indianapolis	2,260	1,036
Los Angeles	1,636	986
Miami	2,445	1,391
New Orleans	1,688	745
New York	1,248	727
Philadelphia	1,817	1,064
Pittsburgh	1,784	1,086
Salt Lake City	2,480	1,418
San Francisco	1,305	805
Seattle	4,929	2,122
Washington	1,838	1,205

Federal Power Commission

customer in 1951, the latest year for which data was compiled, and is about twice what it was in 1941. The range was from 6,730 kwhr in Tacoma, Wash. to 965 kwhr in Lawrence, Mass.

PUDs Get a Shot in the Arm

Chances to buy Puget Sound P&L improved as Washington court allows joint acquisition of private power facilities

Chances of five Washington state PUDs to purchase the Puget Sound Power & Light Co were improved when the state supreme court—by a margin of 6-3—upheld the constitutionality of the 1949 Washington Power Act permitting two or more PUDs jointly to acquire private power facilities.

However, proposed merger of the company with the Washington Water Power Co still would have to be sidetracked before the PUDs would have a chance to consummate their long pending transaction.

The 1949 law was challenged by Ed Roehl of Wenatchee in an action against the PUDs of Chelan, Thurston, Snohomish, Skagit, and Jefferson Counties.

Roehl particularly sought to restrain the Chelan PUD from participating in the five-county purchase and to prohibit the Kitsap PUD from consenting to the purchase although not participating in it, the result of a change in its elected officials.

In regard to the Kitsap PUD, the court ruled the consent had been legally given and could not be withdrawn.

Legislative Study Declined . . . The court majority declined to "enter into the legislative history" of the 1949 Power Act for determining whether that part of the law was enacted in violation of the constitution, as contended by Roehl. Five of the nine judges took this position, with one concurring "in the result reached by the majority," although having expressed himself in a recent case in favor of going behind the face of enrolled bills.

Three justices vigorously dissented. Judge E. W. Schwellenbach, speaking for the minority, declared that "an examination of the legislative history clearly reveals that . . . constitutional restrictions were ignored and violated in enacting this legislation."

The legislature has no right to violate the restrictions on it and the court should investigate the legislative history of the law in formulating its opinion, he said.

Justice Frederick Hamley, in the majority opinion, ruled that the 1949 act was not an amendment to the 1931 law relating to powers of PUDs, acting individually, but supplemental to the earlier act. The law states that districts may not acquire facilities outside the district, and provides no authority for mutual agreements looking to joint acquisition of integrated electric systems.

Joint Action Upheld . . . The majority found that the 1949 law gave two or more districts power, by mutual agreement, to exercise jointly "all powers granted to each individual district. And in our view, the term 'powers' is here used in a broad sense."

The court also ruled that validity of a joint purchase in this case was not dependent upon the seller obtaining prior approval from the State Public Service Commission. Roehl's attorneys had cited a 1941 law under which no public service company could sell its properties without having secured authorization from the commission.

Surcharge Hearings Ended

Counsel for plaintiffs attacking surcharges on billings of three Oregon private utilities as the result of last winter's hydro shortage in the Pacific Northwest have admitted before the Oregon Public Utilities Commissioner that the companies' arguments against customer refunds appear to have legal basis.

Attorney Walter Evans Jr, Portland, told PUC he was in agreement with counsel for the investor owned utilities on their position doubting PUC's Charles H. Heltzel had authority to order the rebate of surcharges the plaintiffs' originally had asked to be impounded.

But while the opposing legal aides stood in apparent agreement on this point, a PUC legal adviser declared Heltzel had such authority if facts of the hearing, in Heltzel's opinion, sustained the plaintiffs' arguments that the surcharges were improper and illegal.

Only Agreement . . . It was the only evidence of agreement as attorneys for the companies declared in their summary of evidence and testimony that the hearing had proved none of the utilities involved earns excessive profits, that they are not guilty of improper practices, and that the past winter's low water condition was an emergency for which "no provision was made to meet it" in existing rate schedules.

PUC Commissioner Heltzel indicated his order would require several weeks to prepare. Heltzel had originally authorized the surcharges last December, based on a hearing of the year previous when a hydro shortage season threatened but was averted.

Record Closed . . . The sudden shift of position by Evans on the rebate question cast new emphasis on other arguments as the commissioner closed the record which had piled in during 23 days of sessions. Bulk of the final statements involved claims by the company lawyers that plaintiff Rep. Monroe Sweetland and officers of the Linn County Farmers Union were concerned more with creating a political issue than establishing proper procedure for PUC regulation of the utilities of the state.

"This has been more of a political hearing than a hearing to determine proper procedure," attorney Allan Smith, representing Pacific Power & Light Co, declared. This was echoed by Clarence D. Phillips, Portland General Electric Co counsel, who noted "political overtones" attached to the hearings by virtue of Sweetland's position as Oregon Democratic

National Committeeman and an open champion of public power.

Phillips accused Sweetland, a PGE customer in Milwaukie, of inconsistency in attacking the companies for alleged laggardness in building its own generating facilities. He said Sweetland was among the state legislators who blocked a bill which would have enabled PGE to advance its proposed Pelton hydroelectric project on the Deschutes river.

Varied Testimony . . . During the sessions preceding the final arguments, company witnesses had testified to details of accounting practices, cost of new capital, effects of inflation on operations, revenue sources, and the rates of return on investment in facilities of PGE, PP&L and Mountain States Power Co.

During the cross-examinations by Evans the complaint moved in the direction of a general argument that surcharges of $4,600,000 in Oregon were caused by failure of the companies to build sufficient hydroplant of their own and a dependency on federal plants of the Columbia basin to meet load conditions during low water years.

A number of independent consulting engineers and experts were called as witnesses while the companies laid out a defense of rates, return on investment, capital costs, and accounting methods.

FINANCIAL BRIEFS

West Penn Power Co has made arrangements with Pennsylvania Salt Manufacturing Co to buy the distribution and transmission system of its subsidiary, Natrona Light & Power Co.

Oklahoma Gas & Electric Co has received Oklahoma Corporation Commission approval to sell 50,000 shares of preferred stock to seven institutions.

New Jersey Board of Public Utility Commissioners rate counsel Joseph Harrison and Wesley L. Lance have told the PUC recently that the 5% surcharge amounting to $1,238,000 sought by the New Jersey Power & Light Co from its customers to recoup alleged deficiences in its earnings is practically unheard of in rate regulations in the United States and Canada.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE 1953									
Sept. 10	**3.30**	**3.35**	**3.55**	**4.33**	**4.53**	**4.80**	**5.34**	**5.82**	**5.94**
Sept. 3	3.30	3.35	3.53	4.31	4.52	4.80	5.34	5.84	5.94
END OF QTR									
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Electric Power Board of Chattanooga	12	June	$1,493,206(a)	$1,272,231(a)	$....	$....
Kansas City Power & Light	12	July	6,308,623	5,261,882	....	....
Texas Power & Light	12	July	8,651,262	7,045,093	....	....
West Penn Electric, consolidated	12	July	13,743,567	12,058,382	3.25(b)	3.04(b)

Notes—(a) These net revenue figures have been audited; (b) Based on 4,224,000 shares in 1953 and, 3,960,000 shares in 1952.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF SEPTEMBER 10–16			
Bonds			
Public Service of New Hampshire—1st mtg 4% due 1983	$7,000	100.874%	3.95%
Louisiana Power & Light—1st mtg 4% due 1983	12,000	100.75	3.96
Common Stock			
Pacific Gas & Electric—1,946,829 sh (being offered commonholders on 1-for-7 basis, record Sept. 15 to expire Oct. 6)	$65,219	$33.50	6.57%
Duquesne Light—184,739 sh (c)	4,780	25.875	6.18
SCHEDULE FOR SEPTEMBER—OCTOBER			
Bonds			
Duquesne Light—1st mtg due 1983	$12,000	.....	Sept. 22
Richmond, Ind—electric revenues 1954–84	6,000	.....	Sept. 23
Indiana & Michigan Electric—1st mtg due 1983	15,000	.....	Sept. 29
Mississippi Power—1st mtg due 1983	4,000	.....	Oct. 6
Public Service Electric & Gas—1st mtg due 1983	30,000	.....	.....
Rockland L&P—1st mtg due 1983	8,000	.....	Oct. 13
Kansas Gas & Electric—1st mtg due 1983	10,000	.....	.....
Los Angeles Department of W&P—revenue bonds	20,000	.....	.....
Preferred Stock			
Duquesne Light—100,000 sh $50 par	$5,000	.....	Sept. 17
Kansas Gas & Electric—50,000 sh $100 par	5,000(f)	.....	.....
Indiana Michigan Electric—70,000 sh	7,000(b)	.....	.....
Common Stock			
New York State Electric & Gas—337,118 sh (to be offered commonholders on 1-for-8 basis, record Sept. 17 to expire Oct. 5)	.....	.....	.....
New England Gas & Electric—194,916 sh (to be offered commonholders on 1-for-10 basis, record Sept. 30 to expire Oct. 16)	.....	.....	.....
Hartford Electric Light—105,500 sh (to be offered commonholders on 1-for-8 basis)	.....	.....	.....
Public Service E&G—800,000 sh	.....	.....	.....
Rockland L&P—210,721 sh (to be offered on a 1-for-7 basis, record Oct. 8)	.....	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Eastern Utilities Associated—collateral trust	$7,000	.....	.....
Monongahela Power—1st mtg	10,000	.....	.....
Long Island Lighting—1st mtg	25,000(e)	.....	.....
Southwestern Public Service—1st mtg	12,000(e)	.....	.....
Preferred Stock			
Southwestern Public Service	$3,000(e)	.....	.....
Common Stock			
Long Island Lighting—about 600,000 sh	$.....	.....	.....
Iowa-Illinois Electric & Gas	6,000(a)	.....	.....
Western Massachusetts Electric	4,000(e)	.....	.....
Southwestern Public Service—(to be offered on about a 1-for-13 basis)	.....	.....	.....
Virginia Electric Power—558,946 sh	.....	.....	.....
Florida Power Corp—210,000 sh (to be offered on 1-for-10 basis)	.....	.....	.....

Notes—(a) To sell enough common stock to yield $6 million; (b) First Boston Corp-Union Securities Corp, will sell the stock to institutions; (c) Including 34,739 shares sold by Standard Power & Light Corp; (e) Estimated; and (f) Company asks FPC to sell the stock privately.

New Electric Generating Facilities

Compiled from Federal Power Commission Records as of August 1, 1953

System or Producer	Plant and/or Location	Type	Capacity Kw	Scheduled Completion
REGION I				
Bangor Hydro Electric	Graham, Veazie Plts., Me.	S	11,500	1954
Central Maine Power	Indian Pond, Kennebec R.	H	22,500	1954
		H	22,500	1954
Rumford Falls Power Co.	Lower Station, Rumford, Me.	H	12,800	1954
Central Vermont Pub Serv	Rutland, Vt.	GT	5,000	1953
Connecticut Light & Power	Thompsonville, Conn.	GT	5,000	1953
		GT	5,000	1953
	Danielson, Conn.	GT	5,000	1953
		GT	5,000	1954
	Montville, Conn.	S	75,000	1954
	Manresa, Norwalk	S	100,000	1956
	Shepaug, Housatonic R.	H	37,250	1955
United Illuminating Co	English, New Haven	S	30,000	1953
Hartford Elec Light	Middleton, Conn.	S	60,000	1954
New England Power	Westerly, R. I.	GT	5,000	1953
	South St, Providence	S	50,000	1954
	Littleton, Conn River	H	140,400 (four units)	1956
	Hopkinton, R. I.	IC	2,500	1954
			2,500	1954
Boston Edison	Edgar, North Weymouth	S	81,250	1954
Public Service of N. H.	Schiller, Portsmouth	S	40,000	1955
Niagara Mohawk	Albany, Albany, N. Y.	S	80,000	1953
		S	80,000	1954
	Huntley, Buffalo	S	80,000	1953
		S	80,000	1953
	South Colton, Raquette	H	19,350	1954
	Five Falls, Raquette	H	22,500	1955
	Rainbow Falls	H	22,500	1955
	Blake Falls	H	14,400	1956
New York State Elec & Gas	Greenidge, Dresden, N. Y.	S	80,000	1953
	Milliken, Lake Cayuga	S	135,000	1955
Rochester Gas & Elec	Russel, Rochester	S	50,000	1953
Central Hudson Gas & Elec	Neversink, Grahamville, N.Y.	H	25,000	1953
	Danskammer, Malsboro	S	50,000	1954
Consolidated Edison, N. Y.	Astoria, L. I., N. Y.	S	160,000	1953
		S	160,000	1954
	East River, Manhattan	S	160,000	1955
Long Island Lighting	Far Rockaway	S	90,000	1953
	Glenwood No. 3, Glenw. Lndg.	S	90,000	1954
	E. F. Barrett, Island Park	S	125,000	1956
Rockland Light & Power	Lovett, Tomkins Cave	S	66,000	1954
	Grahamsville	H	18,000	1955
Atlantic City Elec Co	Deepwater, Pennsv'le, N. J.	S	60,000	1954
Delaware Pwr & Lt	Edgemoor, Wilmington	S	75,000	1954
Jersey Central Pwr & Lt	Raritan Riv, Sayresville	S	125,000	1955
Pennsylvania Electric	Shawville, Clearfield	S	125,000	1954
		S	125,000	1954
	Seward, Johnstown	S	125,000	1956
Pennsylvania Power & Light	Sunbury, Sunbury	S	125,000	1953
	Martins Creek, Del. Riv	S	132,500	1954
		S	132,500	1956
Philadelphia Electric	Delaware Riv, Phila	S	125,000	1953
	Cromby, Phoenixville	S	150,000	1954
		S	200,000	1955
Public Service Elect & Gas	Kearney, N. J.	S	145,000	1953
	Burlington	S	185,000	1954
	Unassigned	S	200,000	1956
Scranton Electric Co	Stanton, Harding, Pa.	S	40,000	1953
Vineland Elect Dept	Vineland, N. J.	S	10,000	1955
Con Gas, Elec Lt & Pwr	Riverside, Baltimore	S	60,000	1953
	Herbert Wagner, Hawkins Pt	S	100,000	1955
Potomac Elec Power	Potomac R, Alexandria, Va.	S	90,000	1954
		S	90,000	1955
Pennsylvania Wtr & Pwr	Holtwood, Pa.	S	66,000	1954
Bethlehem Steel-Industrial	Sparrows Point, Baltimore	S	20,000	1953
	Region 1 Total		**4,831,950**	
REGION II				
Duquesne Light	Elrama, Pa.	S	100,000	1954
	F. R. Phillips, S. Heights	S	125,000	1955
Monongahela Power	Albright, W. Va.	S	125,000	1954
West Penn Power	Springdale, Pa.	S	125,000	1954
Cleveland Dept. Lt. & Pwr	Lake Road, Cleveland	S	125,000	1953
Cleveland Elec Illuminating	Willoughby, East Lake	S	100,000	1953
		S	100,000	1953
		S	100,000	1954
		S	166,400	1955
Columbus & Southern Ohio Elec	Poston, Nelsonville	S	60,000	1953[3]
	Picway	S	80,000	1955
Ohio Edison	Niles	S	106,000	1954[4]
		S	106,000	1953[3]
	R. R. Burger, Dills Bottom	S	135,000	1954
		S	135,000	1954
Detroit Edison	St. Clair, Mich.	S	125,000	1953
		S	125,000	1953
		S	125,000	1954
		S	125,000	1954
Public Lighting Comm	Mistersky, Detroit	S	40,000	1955
Lansing Bd of W & Elec Lt	Moores Park, Lansing	S	40,000	1954
Ohio Valley Electric	Kyger Creek	S	175,750	1955
		S	175,750	1955
		S	175,750	1955
		S	175,750	1956
		S	175,750	1956
	Clifty Creek, Indiana	S	175,750	1955
		S	175,750	1955
		S	175,750	1955
		S	175,750	1955
		S	175,750	1956
		S	175,750	1956
Toledo Edison	Maumee Bay	S	125,750	1955
American Gas & Elec Co: Ohio Power	Muskingum, McConnelsv'le, Ohio	S	175,750	1953
		S	175,750	1954
	Philo	S	120,000	1955
Appalachian Elec. Pwr	Kanawha Montgomery, W. Va.	S	175,750	1953
Indiana & Michigan Elec	Tanners Cr'k, Lawrenceb'g, Ind	S	175,750	1954
Danville W, Gas & El Dept	Brantley, Danville, Va.	S	11,500	1953
U. S. Corps of Engineers	Philpot, Smith River, Va.	H	6,700	Under test
		H	6,700	as of
		H	600	6/30/53
(When they become commercial will be Southeastern Power Admin.)				
Consumers Power	J. D. Whiting, Monroe, Mich.	S	106,000	1953
	J. C. Weadcock, Bay City	S	135,000	1955
	B. C. Cobb, Muckegon	S	135,000	1956
Cincinnati Gas & Elec	Beckjord, Cincinnati	S	100,000	1953
		S	125,000	1954
Dayton Power & Lt	Hutchings, Miamisburg	S	60,000	1953
Fort Wayne Municipal Lt & Pwr Works	Fort Wayne, Ind.	GT	5,000	1954
		GT	5,000	1955
Hamilton Municipal El Plant	Hamilton, Ohio	S	10,000	1953
Indianapolis Power & Lt	White River, Centerton	S	60,000	1954
Louisville Gas & Elec	Cane River, Louisville	S	80,000	1954
		S	80,000	1955
Pub Service of Indiana	Wabash River, Terre Haute	S	90,000	1953
		S	90,000	1954
		S	90,000	1954
		S	100,000	1955
Northern Ind. P. S.	Lake Michigan	S	130,000	1956
Munic. Elec Lt & Pwr Dept.	White Val., Richmond, Ind.	S	30,000	1954
Southern Indiana Gas & El	F. B. Cully, Yankeetown	S	40,000	1955
	Region II Total		**6,646,150**	
REGION III				
irginia Electric Power Co	Portsmouth, Norfolk	S	90,000	1954
	Possum Pt., Dumfries	S	100,000	1955
	Roanoke Rapids, N. C.	H	25,000	1955
		H	25,000	1955
		H	25,000	1955
		H	25,000	1955
Federal	J. H. Kerr, Roanoke R, Va.	H	32,000	1953
		H	32,000	1953
East Kentucky Rural Elec Coop	New Plant	S	20,000	1953
		S	20,000	1954
Kentucky Utilities	Green River, S. Carrolton	S	50,000	1953
Owensboro Municipal Utilities	Owensboro, Ky.	S	30,000	1954
Tennessee Valley Authority	Widow's Cr'k, Bridgep't, Ala.	S	112,500	1954
		S	112,500	1954
	Shawnee, Paducah, Ky.	S	135,000	1953
		S	135,000	1953
		S	135,000	1954
		S	135,000	1954
		S	135,000	1954
		S	135,000	1955
		S	135,000	1955

Symbols: GT—Gas turbine S—Steam H—Hydro IC—Internal Combustion

To Be Installed 1953-56

System or Producer	Plant and/or Location	Type	Capacity Kw	Scheduled Completion
	Swans Pond, Kingston, Tenn.	S	135,000	1954
		S	135,000	1954
		S	135,000	1954
		S	135,000	1954
		S	180,000	1954
		S	180,000	1954
		S	180,000	1954
		S	180,000	1955
	Colbert, Ala.	S	180,000	1954
		S	180,000	1954
		S	180,000	1955
		S	180,000	1955
	J. Sevier, Rogersv'le, Tenn.	S	180,000	1955
		S	180,000	1955
		S	180,000	1956
	Gallatin, Tenn.	S	225,000	1955
		S	225,000	1956
	Boone, S. Holston River	H	25,000	1953
	Pat. Henry, Holston River	H	18,000	1953
		H	18,000	1954
	Cherokee, Holston River	H	30,000	1953
	Fontana, Little Tenn River	H	67,500	1953
	Douglas, French Broad River	H	26,000	1954
	Chatgue, Hiwassee River	H	10,000	1954
	Hiwassee, Hiwassee River	H	59,500	1955
	Nottely, Nottely River	H	15,000	1955
Nantahala Pwr & Lt.	Bear Creek, L'tle Tenn. R.	H	9,000	1953
Industrial	Tenn. Cr'k Dam, L'tle Tenn. R.	H	10,000	1954
U. S. Corps of Eng.	Dale Hollow, Cumberland B'sn.	H	18,000	1953
	Old Hickory, Cumberland B'sn.	H	25,000	1956
		H	25,000	1956
		H	25,000	1956
Carolina Power & Light	Wilmington, N. C.	S	99,000	1954
Duke Power	Buck, Spencer, N. C.	S	125,000	1953
		S	125,000	1953
	River Bend, Charlotte, N. C.	S	133,000	1954
		S	133,000	1954
	Dan River, Greensboro, N. C.	S	140,000	1955
South Carolina Elec & Gas	Urquqart, Aikens, S. C.	S	75,000	1953
		S	75,000	1953
		S	100,000	1955
So. Carolina Pub Serv Auth.	Pinopolis, Berkeley Dist.	S	40,000	1953
		S	40,000	1953
Alabama Power	James Barry, Mobile, Ala.	S	125,000	1953
		S	125,000	1954
	Gorgas, Ala.	S	156,250	1955
Georgia Power	Hammond, Rome, Georgia	S	100,000	1955
		S	100,000	1954
		S	100,000	1954
	Goat Rock, Chattahoochie R.	H	5,000	1955
		H	5,000	1955
Gulf Power	River Junction, Fla.	S	40,000	1953
Alabama Elec Coop.	Gantt, Ala.	S	7,500	1953
		S	7,500	1953
Savannah Elec Power	Riverside, Ga.	S	20,000	1954
Buford Federal Plant	Chattahoochie River, Ga.	H	40,000	1956
Clark Hill-Federal	Savannah River, Ga.	H	40,000	1953
		H	40,000	1954
		H	40,000	1954
		H	40,000	1954
Florida Power	Suwannee, Ellaville, Fla.	S	30,000	1953
		S	30,000	1954
	Higgens, Safety Harbor	S	40,000	1953
	Turner, Enterprise, Fla.	S	60,000	1955
Florida Power & Lt.	Riviera, Fla.	S	56,470	1953
	Cutler, Fla.	S	56,470	1954
		S	100,000	1955
Jacksonville Elect. Dept.	Southside, Jacksonville	S	40,000	1955
	Talleyrand Ave.	S	40,000	1955
Orlando Utilities Comm.	Orlando, Fla.	S	30,000	1953
Tallahassee Elec. Dept.	St. Marks, Fla.	S	7,500	1954
Tampa Electric Co.	Hookers Point, Tampa	S	40,000	1953
		S	60,000	1955
Jim Woodruff-Federal	Apolachicola River, Fla.	H	10,000	1954
		H	10,000	1954
		H	10,000	1954
	Region III Total		**8,006,690**	

REGION IV

Edison Sault Electric	Mackinac	IC	850	1953
Madison Gas & Elec.	Blount St., Madison, Wis.	S	30,000	1953
Manitowoc Public Utilities	Manitowoc, Wis.	S	20,000	1955
Wisconsin Electric Power	Oak Creek, Milwaukee	S	120,000	1953
		S	120,000	1954
Wisconsin-Michigan Power	Hemlock Falls, Michigamme R.	H	2,800	1953
Wisconsin Power & Lt.	Rock River, Beloit	S	60,000	1953
		S	60,000	1955
Wisconsin Public Service	Weston, Rothschild, Wis.	S	60,000	1954
Central Illinois Elec & Gas	Sabrooke, Rockford	S	30,000	1955
Chicago Dist. Elec. Gen. Corp	Stateline, Hammond, Ind.	S	191,000	1955
Commonwealth Edison	Ridgeland, Stickney, Ill.	S	150,000	1953
		S	150,000	1954
	Will County, Ill.	S	150,000	1954
		S	150,000	1954
	Dixon, Ill.	S	60,000	1953
Union Electric of Missouri	Meramec, St. Louis, Mo.	S	110,000	1954
	Osage, Osage River, Mo.	H	21,500	1953
Dairyland Power Coop.	Stoneman, Cassville, Wis.	S	34,500	1953
Minnesota Power & Lt.	Aurora, Minn.	S	44,000	1953
Northern States Power	Black Dog, Minneapolis	S	90,000	1954
		S	90,000	1955
	Minn Valley, Granite Falls	S	40,000	1953
Rochester Elec. Lt Dept.	Silver Lake, Minn.	S	11,500	1953
Corn Belt Power	Humbolt, Iowa	S	15,000	1953
Iowa-Illinois Gas & Elec.	Moline, Ill.	S	20,000	1954
Iowa Power & Lt.	Sta No. 2 Des Moines, Iowa	S	60,000	1954
	Council Bluffs, Iowa	S	40,000	1954
Kansas City Power & Lt.	Hawthorne, Kansas City	S	100,000	1955
Interstate Power	Lansing, Iowa	S	30,000	1956
Iowa Electric Light & Power	Boone, Iowa	S	15,000	1953
	Marshalltown, Iowa	S	30,000	1954
		S	30,000	1955
Iowa Public Service	Hawkeye, Storm Lake, Iowa	S	11,500	1953
Iowa Southern Utilities	Bridgeport, Eddyville	S	20,000	1953
		S	20,000	1953
Kansas City Board of Public Utilities	Kansas River	S	40,000	1954
		S	40,000	1956
Central Ill. Publ Serv.	Hutsonville, Ill.	S	60,000	1954
Electric Energy Inc.	Joppa, Ill.	S	156,000	1953
		S	156,000	1953
		S	156,000	1953
		S	156,000	1953
		S	156,000	1955
		S	156,000	1955
Illinois Power	Vermillion	S	60,000	1955
		S	90,000	1956
	Wood River	S	90,000	1953
Springfield W., Lt & Pwr Dept.	Lakeside, Springfield, Ill.	S	20,000	1953
	Region IV Total		**3,523,650**	

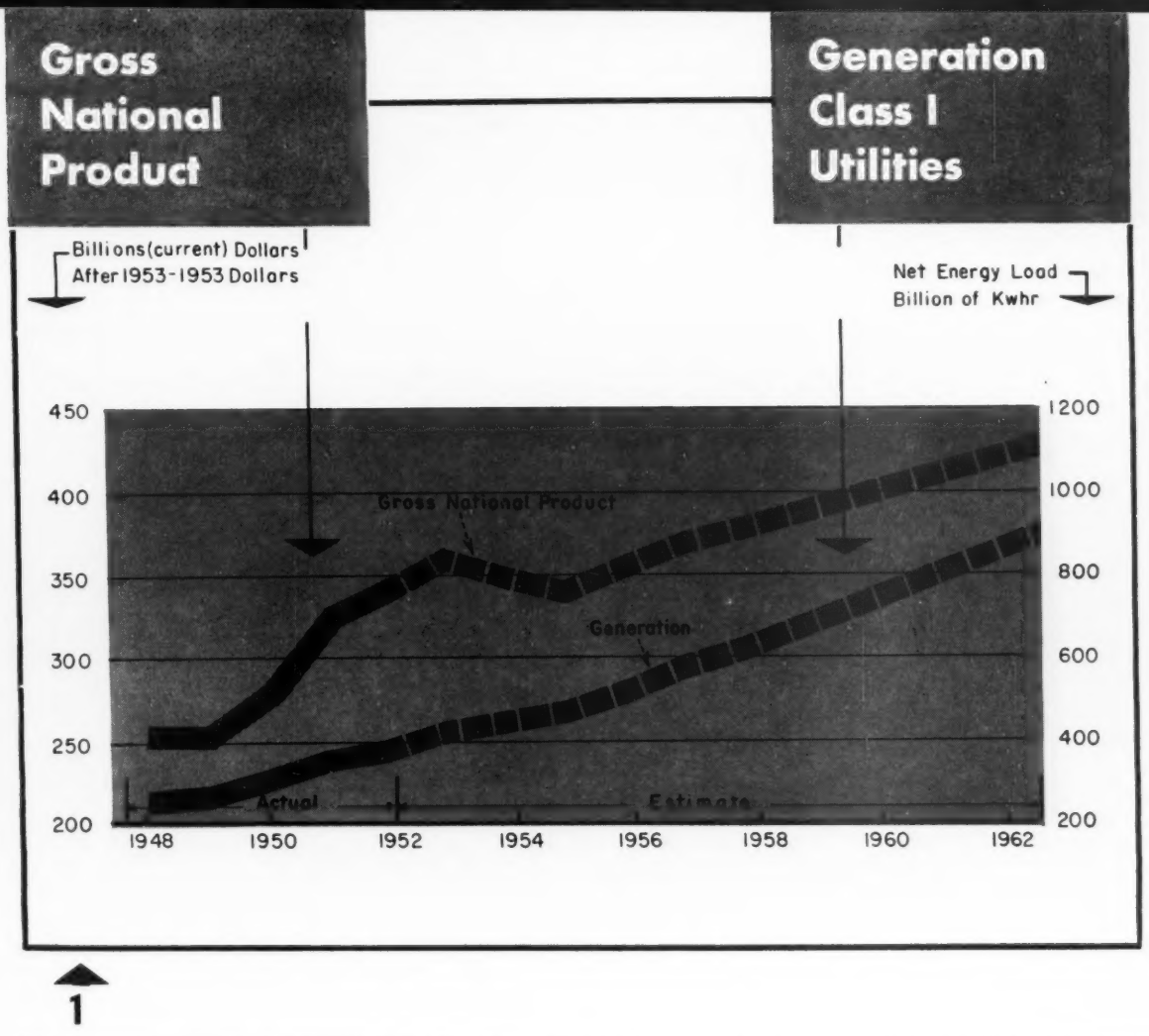
REGION V

Arkansas Power & Lt.	Lynch	S	125,000	1954
	Couch	S	125,000	1954
Louisiana Power & Lt.	Nine Mile Point, Weswego	S	125,000	1955
Mississippi Pwr & Lt.	Delta, Cleveland, Miss.	S	99,000	1953
		S	99,000	1954
New Orleans Pub Serv.	A. B. Patterson, New Orleans	S	81,250	1954
Blakely Mountain-Federal	Ouachita River, Ark.	H	37,500	1954
		H	37,500	1954
Fort Gibson	Grand River, Okla.	H	12,300 (under test)	1953
Central Kansas Power	Ross Beach, Hill City	S	11,500	1953
Kansas Power & Lt.	Lawrence, Kans.	S	40,000	1954
Western Lt & Tele Co.	Arthur Mullergren, Kans.	S	15,000	1953
Grand River Dam Auth.	Choteau, Okla.	S	30,000	1955
Okla Gas & Elec.	Mustang	S	100,000	1955
Pub Serv of Okla.	Carnegie, Okla.	S	80,294	1954
	Tulsa, Okla.	S	40,000	1956
Southwestern Gas & Elec.	Daingerfield, Texas	S	40,000	1954
	Knox Lee, Longview	S	60,000	1955
Tankiller Ferry-Federal	Illinois River, Okla.	H	17,000	1953
		H	17,000	1953
Empire District Electric	Riverton, Kans.	S	40,000	1954
Kansas Gas & Elec.	Murray Hill, Wichita	S	60,000	1953
	Neosho Falls, Kans.	S	60,000	1954
Missouri Public Service	Pleasant Hill	S	22,000	1954
Gulf States Utilities	Louisiana St, Baton Rouge	S	40,000	1954
		S	40,000	1954
	Nelson, Scott	S	90,000	1956

PLEASE TURN PAGE

New Generating Facilities 1953-1956 (continued)

System or Producer	Plant and/or Location	Type	Capacity Kw	Scheduled Completion
REGION V (Continued)				
Lubbock Elec Dept	No. 2, Lubbock, Texas	S	11,500	1953
Southwestern Public Service	"X"—Earth, Texas	S	80,000	1953
		S	80,000	1955
	Denver City No. 4, Texas	S	40,000	1954
	Moore County, Sunray Tex.	S	40,000	1954
Dallas Power & Light	Griffin St. Dallas	S	60,000	1954
	Parkdale, E Dallas	S	100,000	1955
	Mountain Creek, Dallas	S	140,250	1956
Texas Power & Light	River Crest	S	80,000	1954
	Collins County	S	145,000	1955
Texas Electric Service	Morgan Cr'k, Colorado C'y.	S	60,000	1954
	Eagles M'n, Tarrant C'nty	S	110,000	1954
		S	156,000	1956
West Texas Utilities	Girvin, Texas	GT	5,000	1954
		S	30,000	1955
Austin W, Lt & Pwr Dept	Austin, Texas	S	22,000	1954
		S	22,000	1954
		S	22,000	1955
Central Power & Lt	Calallen, Texas	S	60,000	1954
	Victoria, Texas	S	60,000	1955
	Laredo, Texas	S	30,000	1955
Houston Lighting & Power	Webster, Houston	S	100,000	1954
		S	100,000	1955
	Deepwater, Pasadena, Tex	S	156,000	1955
	San Jacinto	S	156,000	1956
City Pub. Serv. Board	Northside, San Antonio	S	60,000	1954
Int'l. Boundary Water Comm.	Falcon Dam, Rio Gr. R., Tex.	H	10,500	1954
		H	10,500	1954
		H	10,500	1954
El Paso Electric	Rio Grande, El Paso	S	33,000	1954
Public Serv of N. Mexico	Person, Albuquerque	S	20,000	1953
		S	30,000	1954
	Region V Total		**3,584,594**	
REGION VI				
Montana Dakota Utilities	Williston, N. D.	GT	8,000	1953
	Mandan N. D.	S	25,000	1954
Otter Tail Power	Bemidji, Minn.	IC	3,000	1953
Fort Randall-Federal	Missouri River, S. D.	H	40,000	1954
		H	40,000	1954
		H	40,000	1954
		H	40,000	1954
		H	40,000	1955
		H	40,000	1955
		H	40,000	1955
		H	40,000	1956
Garrison-Federal N. D.	Missouri River, N. D.	H	80,000	1955
		H	80,000	1955
		H	80,000	1956
Gavins Point-Federal	Missouri River, S. D.	H	33,333	1956
		H	33,333	1956
Omaha Public Power Dist.	N. Omaha	S	60,000	1953
Alcova Federal Project	N. Platt River, Wyo.	H	18,000	1955
		H	18,000	1955
Colorado/Big Thompson Diversion—Federal	Pole Hill, Colo.	H	16,625	1953
		H	16,625	1953
	Flatiron Mountain, Colo.	H	31,500	1953
		H	6,700	1953
		H	31,500	1954
Colorado Springs Dept. of Pub. Utilities	North Sta	S	15,000	1953
		S	15,000	1953
Pub Serv of Colorado	Alamosa, Colorado	S	10,000	1953
	Zuni, Denver	S	66,000	1954
	Cherokee	S	100,000	1955
Western Colo. Power	Jim Bullock, Montrose	S	5,000	1953
	Region VI Total		**1,072,616**	
REGION VII				
Montana Power	Kerr, Flathead River	H	56,000	1954
Canyon Ferry-Federal	Missouri River, Mont.	H	16,666	1953
		H	16,666	1953
		H	16,666	1953
Utah Power & Light	"X", Carbon County	S	66,000	1954
	"Y", Carbon County	S	100,000	1955
Pacific Power & Light	Yale, Lewis River, Wash.	H	54,000	1953
		H	54,000	1953
Portland General Electric	"B", Clackamus River, Ore.	H	10,600	1953
		H	3,600	1953
		H	1,200	1953
Pend Oreille Elec Coop	Box Canyon, Wash.	H	15,000	1954
		H	15,000	1954
		H	15,000	1954
		H	15,000	1954
Washington Water Power	Cabinet Gorge, Cabinet, Idaho	H	50,000	1953
		H	50,000	1953
McNary-Federal	Columbia River, Wash/Ore.	H	70,000	1953
		H	70,000	1953
		H	70,000	1954
		H	70,000	1954
		H	70,000	1954
		H	70,000	1954
		H	70,000	1955
		H	70,000	1955
		H	70,000	1955
		H	70,000	1956
		H	70,000	1956
		H	70,000	1956
Chief Joseph-Federal	Columbia River, Wash.	H	64,000	1955
		H	64,000	1955
		H	64,000	1955
		H	64,000	1955
		H	64,000	1956
		H	64,000	1956
		H	64,000	1956
		H	64,000	1956
Hungry Horse-Federal	Flathead River, Mont.	H	71,250	1953
		H	71,250	1953
Albeni Falls-Federal	Pend Oreille River, Idaho	H	14,200	1954
		H	14,200	1954
		H	14,200	1955
Chandler-Federal	Kennewick Canal, Wash.	H	6,000	1955
		H	6,000	1955
Seattle Dept. of Lts	Ross—Skagit River	H	90,000	1953
Tacoma Dept. of Pub. Ut.	No. 2, Tacoma	S	20,000	1954
		GT	4,000	1954
		GT	4,000	1955
California Oregon Power	Clearwater, N. Umpqua R., Ore.	H	26,000	1953
	Lemola, N. Umpqua R., Ore.	H	29,000	1954
		H	33,000	1955
	Big Bend 2 or McCloud-Kalmouth R.	H	25,000	1956
		H	25,000	1956
Detroit-Federal	North Santium R, Ore.	H	50,000	1953
		H	50,000	1953
Big Cliff-Federal	North Santium R, Oregon	H	18,000	1954
Lookout Point-Federal	Willamette River, Oregon	H	38,000	1954
		H	38,000	1954
		H	38,000	1954
Dexter—Federal	Willamette River, Oregon	H	15,000	1955
	Region VII Total		**2,747,498**	
REGION VIII				
Pacific Gas & Electric	Contra Costa	S	100,000	1953
		S	100,000	1953
	Pittsburg	S	125,000	1954
		S	125,000	1954
		S	125,000	1954
		S	125,000	1954
	Morro Bay	S	125,000	1955
		S	125,000	1955
	Eureka	S	50,000	1955
	Murphys, Kings River	H	3,600	1953
	Pitt 4, Kings River	H	90,000	1955
Central Valley Project-Fed'l.	Folsom, American River	H	54,000	1955
		H	54,000	1955
		H	54,000	1955
	Nimbus, American R.	H	6,750	1955
		H	6,750	1955
Burbank Public Serv Dept		S	30,000	1953
California Elec Power	Highgrove, San Bernardo	S	40,000	1953
		S	40,000	1955
Glendale Pub. Serv. Dept		S	20,000	1953
Imperial Irrigation Dist	Drop 2 All American Canal, Calif.	H	5,000	1953
		H	5,000	1953
Los Angeles Dept of W & Pwr	Owens River Gorge Valley, Seal Beach	H	37,500	1953
		S	80,000	1954
		S	80,000	1954
		S	125,000	1954
		S	125,000	1955
asadena Munic. Lt & Pwr Dept	Broadway, Pasadena	S	40,000	1954
		S	40,000	1956
San Diego Gas & Elec	Encina, Carlsbad, Calif.	S	80,000	1954
Southern Calif Edison	Etiwanda—Fontana	S	100,000	1953
	Redonda 2	S	125,000	1954
		S	125,000	1955
Arizona Pub Serv	Saguaro, Red Rock, Ariz.	S	90,000	1954
Salt River Power Dist.	Kyrene, Ariz.	S	69,000	1954
Tucson Gas, Elec Lt & Pwr.	De Moss Petrie, Tucson	S	40,000	1954
	Region VIII Total		**2,565,600**	
	United States Total		**32,978,748**	



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Electrical Industry Forecast for 1954-63

Electrical World Study Shows Sustained Growth for the Industry Despite Period of Recession

FISCHER BLACK, EDITOR

A decade of unusual growth lies ahead for the electrical industry. The present decade closing in 1953 ends with the biggest growth year in the 75 of the industry's history. Looking ahead to 1963, the curve of progress is like a chain of mountains, each rising higher than the one before.

Despite seven prosperous years since 1946 during which capacity and sales doubled, the industry will again duplicate this record by 1963. Growth like this can come only in a country where there is free enterprise. And growth like this where there is free enterprise can mean only higher living standards for all.

The electrical industry will have its ups, other industries the downs. This means that we expect many of the nation's industries to be plagued with a recession before 1963. But still the forecast for the electrical industry is steadily up at a moderate rate.

This prediction is based on the fact that the high standard of American living depends on the use of electricity. From the shop to the home the demand for power is rising. And atomic power, which someday may provide electricity, is now demanding astronomical amounts. To supply the many demands the utilities must expand. And in their expansion they will carry with them all other branches of the industry.

Table I—The Economic Outlook

Year	Gross [1] National Product	Consumer [1] Disposable Income	FRB Index Industrial Production	Home Completion (Thousands)	Family Formation (Thousands)	Occupied Homes [2] or Households (Millions)
1948	$259	$188	192	1,000	1,180	41.6
1949	258	187	176	900	1,160	43.0
1950	284	206	200	1,450	930	44.1
1951	329	225	220	1,200	760	45.2
1952	346	234	219	1,100	760	46.2
FORECAST						
1953	365	248	237	1,100	750	47.1
1954	355	243	223	900	675	47.9
1955	346	239	215	900	625	48.6
1956	360	253	230	900	600	49.3
1957	375	265	245	900	600	50.0
1958	387	275	254	900	675	50.8
1963	435	310	282	1,200	725	54.8

[1] Current dollars; 1953 dollars after 1952; Billions of Dollars. [2] Year end estimated. Forecast by McGraw-Hill Department of Economics.

The Business Trend Is Down

Economists and business men expect a mild recession. They point to various factors which affect the nation's economic life. However, the electrical industry has many stabilizing forces which make it less vulnerable and will even permit it to expand

The electrical industry has many stabilizing forces that make it less vulnerable to recession than most of the others. As shown in Chart 1, the mild recession that has been predicted by the McGraw-Hill Department of Economics will have little effect upon the growth of the electric utilities and their suppliers.

The reasons why business men and economists expect a recession are many. Some stick mainly to the old idea that business is made up of a series of cycles, and it is now time for a downswing. The more studious look to consumer disposable income, installment credit, home building activity, inventories, and other similar evidence of the health of the economy. At the present time the most critical indications are the level of installment credit and the inventory accumulations that have inflated the market for durable goods over the past 12 months. Adding this to the cutbacks in the defense program, we have a mathematical base for the reduction in the Gross National Product that is predicted by the McGraw-Hill Department of Economics.

AEC Power Use not Included . . . The accompanying Table I of historical and predicted trends in the national economy includes those items which are in major influence on the growth of the electrical industry. Important data not included in the table are governmental expenditures which are a part of the Gross National Product and the use of power by the Atomic Energy Commission. For instance, it is expected that the use of power at the major AEC installations supplied by the Tennessee Valley Authority, Electric Energy Inc, The Ohio Valley Electric Co. and South Carolina Electric & Gas Co may reach 50 billion kwhr by 1958. This item alone is more than 10% of the estimated 1953 production and more than 25% of the sales to all large light and power customers.

The basis for the estimates shown on the accompanying table has been summarized by the Department of Economics as follows:

Gross National Product . . . The recession expected in business activity in the next two years is anticipated as stemming primarily from five developments:

1. Initially, a temporary phenomenon of readjustment of business inventories which have been expanding rapidly in recent months. They were at the annual rate of $8.8 billion in the second quarter of this year.

2. A decline in government expenditures, mainly defense and foreign aid as the Administration tries to balance the budget.

3. A lower rate of business investment in new plant and equipment, resulting from completion of most expansion programs that were started in connection with the defense program.

4. A lower rate of expenditures for new housing.

5. Lower farm income.

For an idea of the magnitude of these items it should be pointed out that military spending is now more than $50 billion, business capital spending more than $28 billion, and new private housing around $12 billion.

The decline in business activity is not expected to reach really serious proportions for the following reasons:

1. The government is committed to take all necessary steps to prevent a depression and must do so to the extent it is able for political reasons as well as for the good of the economy.

2. The government has the tools, in tax cuts and increased spending, to fight a recession effectively. A decrease in the net income of business will automatically reduce taxes and increase the relative spending of government to tax income.

3. Business plans to invest at a high rate after 1953, even though not at the recent record rates.

4. Consumers will still have relatively high incomes and are expected to spend them.

In short, the drop in the Gross National Product is not expected to be severe, nor should it last for an extended period. The drop shown in the table of $19 billion by 1955 is only 5% of the estimated $365 billion for 1953.

Disposable Income . . . The decline in business activity will reduce consumer income, but not severely. Lower tax payments will partly offset the decline in income. However, the economy has recently been accustomed to a steady rise in consumer income. Many purchases by consumers, especially of appliances, homes, and autos, have been paid for out of annual increases in wages. Sales of goods of this sort are most likely to be affected by the change in disposable income.

Consumer Expenditures . . . Consumers are expected to spend in the next two years at rates only slightly below those of 1953. This is predicted in spite of their declining income. There is considerable reserve buying power available in the form of current savings that can be diverted to consumption. There is also a sizeable amount in accumulated savings. However, some marginal consumers with insecure jobs and no savings will be in trouble. This latter group has been buying quite a few appliances and other goods in recent years.

Industrial Production . . . The decline in business will be concentrated in military goods, capital goods, and consumer durables. All of these will be affected more sharply than other goods and services included in the Gross National Product. In the period immediately ahead it is expected that a downward trend in these segments of the economy will be seen. Of course, it is in this area that new peaks have been established month after month during the past year. It is in these business groups where the effects of inventory accumulation and installment credit have been felt most.

A maximum reduction of 10% in industrial production over a two year period is forecast. This small drop cannot produce many serious dislocations in the economy.

Family Formations . . . The expected decline in the rate of new family formations is almost entirely the result of the smaller number of people reaching marrying age in the next few years. This is a result of the low birth rate in the early thirties with which everyone is acquainted. Compared with about 1,200,000 families formed in 1948, we will be down to 600,000 in a couple of years.

Occupied Homes . . . Annual additions to the number of occupied homes will also decline as a result of the lower rate of family formation. The doubling-up which put pressure on the housing market no longer exists to any extent. Occupied homes follow the trend of family formations very closely.

Home Completions . . . The number of homes completed will be lower in the next few years primarily because of the following factors:

1. Family formation will be declining.

2. There are signs that there is some over-building. It shows up in declining starts and reports of difficulty with sales.

3. There are increased problems of financing homes which are not being solved by the recent increase in FHA and Veterans Administration mortgage rates.

4. Consumers' incomes will not rise as fast as they have in recent years and, in fact, may decline for a year or two.

The prices used in these statistics are current for the year shown except those after 1953. They are held to the 1953 level. Changes in the price level will have a corresponding effect upon the Gross National Product and consumer income. Data covering the electrical industry would be influenced to a lesser degree but in the same direction. This problem is covered further in succeeding pages.

In Summary . . . In this report on the business outlook and its effect upon the electrical industry, we are trying to give the best current opinion upon all factors. Here we have presented the economic forecast as prepared by the McGraw-Hill Department of Economics. It is more optimistic than some but is near that of the majority. In the pages to follow, the growth of the electrical industry is related to each of the economic factors. Because the electrical industry is of such fundamental importance to the economy, its trend can be related to each element very closely. The opinions of others who forecast the growth of the industry have been solicited, and their conclusions compared with ours. For the next few years we are more optimistic than some. But for the next ten-year growth, we tend to be on the low side in some respects. As the effect of a recession upon the operations of the electric utilities is of such current interest, we are also presenting two outstanding authorities on this subject as a part of this special issue.

New Era In Electrical Industry Growth

A high level of consumer income, continued rapid increase in population, and demand for new electrical appliances to support electrical industry growth in 1954. Ten year forecast shows industry doubling

Our preliminary forecasts for 1953 indicate that many records will be equalled or bettered in the growth of the electrical industry. As indicated in the annual statistical issue of Electrical World (Jan. 26), the electric utilities will spend a record $4.2 billion for capital expansion. Consumers will spend more than the $6 billion spent last year for electrical appliances. And the construction and industrial uses of electrical equipment will reach new peaks unthought of some few years ago.

The output of electricity for Class I Systems in the United States will reach around 443 billion kwhr, showing a record increase of 45 billion kwhr. This exceeds the previous maximum growth of 42 billion recorded in 1951. The Edison Electric Institute's Electric Power Survey Committee has estimated a peak load increase of 10 million kw compared with our estimate of 9.2 million kw. This difference can probably be accounted for by the assumed drop in industrial production at the end of the year reflected in our forecast. Capacity increase will amount to 9.5 million kw compared with original schedules of 13.5 million kw.

Everybody Will Buy More Power . . . In the individual categories of sales new records will also be made. Large light and power sales will be up some 20 billion kwhr slightly more than in 1950 and 1951. Sales to the Atomic Energy Commission's installations contribute to this growth. Small light and power will be slightly under its record growth of 1951.

In the residential category customers added will run about 1.4 million compared with 1.8 million in 1951. But the increase in the average use per customer will be around the 174 kwhr recorded in 1951 giving a higher total gain than in that year because of the two-year increase in total residential customers.

Revenue from the sale of electrical energy will also reach new peaks this year. Compared with an increase of $562 million in 1951, the gain for 1953 is predicted to be $606 million. The average rate will be around 1.77¢ per kwhr compared with 1.78¢ per kwhr in 1951.

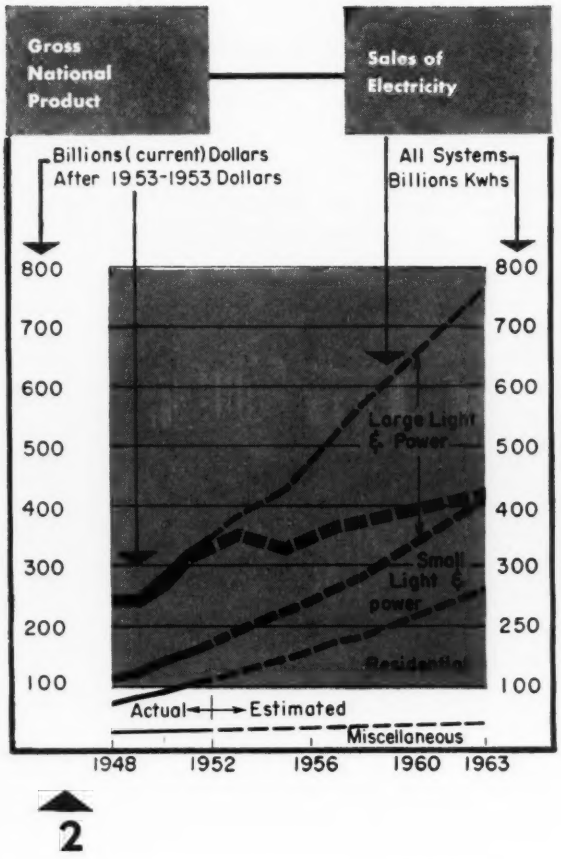
Forecast for Fifty-Four . . . The uncertainties of the business outlook have clouded the vision of business trends for most industries. This is less true for the power equipment and utility segments of industry than for most of the others. The forward buying of the utilities, based upon forecasts of substantial growth for all customer groups, accounts for the confidence in these two industrial fields.

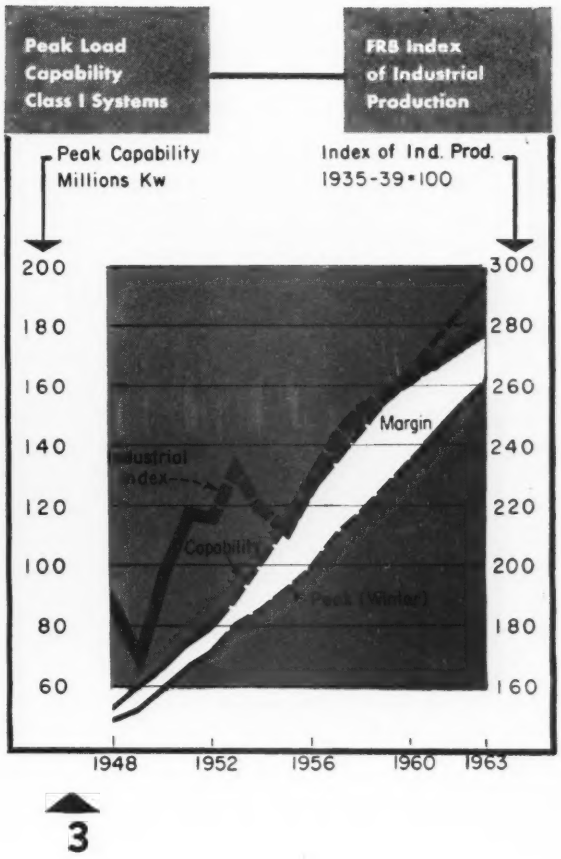
Capital expenditures by electric utilities will increase again in 1954 to an estimated $4.5 billion. The increased activity in the field of power generation and transmission facilities along with the large distribution additions for

Table II—Electrical Industry Outlook

YEAR	RESIDENTIAL		SMALL LIGHT & POWER		LARGE LIGHT & POWER	MISC.	TOTAL	OUTPUT[2]	PEAK[3-4]	LOAD FACTOR	GENERATING CAPABILITY	MARGIN
	Customers[1] (Millions)	Sales (Billion Kwhr)	Customers[1] (Millions)	Sales (Billion Kwhr)	Inc. Sales to AEC (Billion Kwhr)	(Billion Kwhr)	Sales[2] (Billion Kwhr)	(Billion Kwhr)	Load (Millions Kw)	%	(Millions Kw)	% Peak[5]
1948	32.6	51.0	5.0	43.2	124.1	22.4	240.7	277.0	51.1	61.9	54.5	6.6
1949	34.5	58.1	5.2	46.3	120.8	23.3	248.5	287.6	54.0	60.8	61.6	14.2
1950	36.6	67.0	5.4	50.4	139.1	24.0	280.5	328.6	61.4	60.5	67.5	9.9
1951	38.4	77.0	5.5	57.3	157.8	26.1	318.2	370.9	68.1	62.1	76.2	11.9
1952	40.0	86.8	5.6	62.1	167.4	26.2	342.5	398.0	72.8	62.4	81.4	11.7
FORECAST												
1953	41.4	97.0	5.7	68.0	189.0	27.0	381.0	443.0	82.0	61.6	91.0	11.0
1954	42.7	107.0	5.8	73.0	196.0	28.0	404.0	469.0	87.0	61.5	102.0	17.3
1955	43.8	118.0	5.9	79.0	203.0	29.0	429.0	498.0	93.0	61.0	114.0	22.6
1956	44.8	129.0	6.0	84.0	230.0	30.0	473.0	548.0	101.0	61.5	125.0	23.8
1957	45.8	140.0	6.1	91.0	260.0	31.0	522.0	603.0	111.0	62.0	136.0	22.5
1958	46.9	152.0	6.2	100.0	278.0	32.0	562.0	650.0	119.0	62.0	146.0	22.6
1963	52.4	226.0	6.6	150.0	349.0	38.0	763.0	878.0	162.0	62.0	198.0	22.2

[1] Average for year; [2] All systems; [3] Class I Systems; [4] Winter Non-simultaneous Peaks; Winter peak margin has little relation to margin at time of individual system peak as summer loads increase. Forecast by Electrical World.





current and expected load growth account for this increase in 1954. Most of the gain in capital expenditures is expected in the power generation and transmission facilities. The necessity of building up capacity reserves along with the stimulant of the generating equipment for Atomic Energy installations accounts for this situation.

Because growth of the electrical industry depends upon the total rate of business activity rather than the changes, its rate of growth is the only uncertain factor. The basis for this statement is explained in detail in the discussions of the growth of individual customer groups in the sections to follow. The accompanying Chart 2 shows the relative comparison of the increase in use of electricity with the change in total goods and services produced.

The Next Ten Years . . . In forecasting the growth in electric energy sales, peak loads, and revenue, we have relied entirely upon the economic trends previously described. It turns out that the output curve does stay relatively close to a 7% per year growth, but this is not the basis for our predictions. We believe that it is important for the industry to arrive at more accurate methods of forecasting, so we have developed and included some new devices for reaching this end.

Growth of the electrical industry will depend much more upon the sale of electrical appliances and equipment over the next ten years than in the past. This is true because of the lower rate of new home building and new customer additions and less expansion in the industrial capacity. But the acceptance of the many new appliances as necessities in the home and office will be confirmed in that period. The modernization of industrial plants is one of the most important areas for increased use of electrical energy in this area. The general acceptance by business men of the philosophy of the need to improve the productivity of labor to maintain prices and increase the standard of living of all the people is the key to electrical industry growth. The expanding use of new metals whose production requires large amounts of electric power is a further stimulant to the industrial use of electricity.

More Output and a Higher Peak . . . In total we are forecasting a doubling of the output of electrical energy in the next ten years. The rate of growth which averages 7% per year drops down to 6% for the next two years. This substantial growth is due primarily to the residential and small light and power customers along with Atomic Energy Commission requirements.

The peak load will increase in proportion to the production of electricity. Although certain uses of electricity will tend to produce an increase in the load factor, the heavy heating and cooling facilities will offset these items.

As shown in Chart 3, the capability of generating facilities will more than double over the next ten years. This is due to the necessary increase in reserve to an average from 15% to 20% for individual systems and the total to 22% for the industry as a whole based upon the winter peak. By 1963 a much larger number of utility systems will be experiencing a summer peak. The relation of peak loads and capacity to the industrial activity is shown on Chart 3. It is obvious from this comparison that the short duration of the expected recession has little effect other than providing a breathing spell to catch up on capacity additions.

To Spend $50 Billion in Ten Years . . . Over the next ten years, on the basis of 1953 dollars, it is predicted that the electric utilities, both public and private, will spend about $50 billion for power system facilities. This will be just twice as much as that spent in the past ten years. It would appear that the type of equipment purchased would be that needed to provide for load growth to a far greater extent than in the past. Most areas of the country will be well covered with distribution circuits in the near future.

Revenues Must Double . . . In order to pay for this expansion in the electric power facilities of the country, the utility revenues must double in the next ten years as they have in the past ten. It is predicted that revenues will increase from an estimated $6.7 billion in 1953 to a total of $13.2 billion by 1963 for all agencies. This can be accomplished with no average increase in cost per kwhr of energy. In fact it is estimated that the average price of electric energy will decrease in ten years from 1.77¢ per kwhr to 1.72¢ per kwhr. This allows for increases in the residential and commercial rates to cover the increased capital cost of facilities. It assumes that the low cost industrial sales to metallurgical and atomic energy plants will offset any increase that occurs for ordinary industrial use.

In summary, we do not foresee any difficulties in financing the new facilities required to supply the power requirements of the country. And it is believed that the rates charged will be low enough to permit the expansion in the use of electrical energy that had been previously forecast.

Residential Use Leads

Home use of electricity is found to vary with disposable income thereby placing a floor under rate of growth. Forecast is that the consumption of energy by those in this classification will increase by 11 billion kwhr a year in spite of a slump

Increased use of electricity by residential customers has shown phenomenal growth over the past few years. Beginning with the 15% gain in 1945, the percentage rate of growth has gradually decreased to a predicted 12% in 1953 and 10% in 1954. The real gain in residential use has been rather stable at around 10 billion kwhr per year. It is predicted that although the percentage gained continues to decrease in 1954 and 1955, the real increase will grow to 11 billion kwhr per year in these two years.

These predicted sales to residential customers as shown in Table II amount to 97 billion kwhr in 1953 and 107 billion in 1954, with an increase in customers of 1.4 million in 1953 and 1.3 million in 1954. It is expected that the increase use per customer will amount to 174 kwhr in 1953 and approximately the same in 1954.

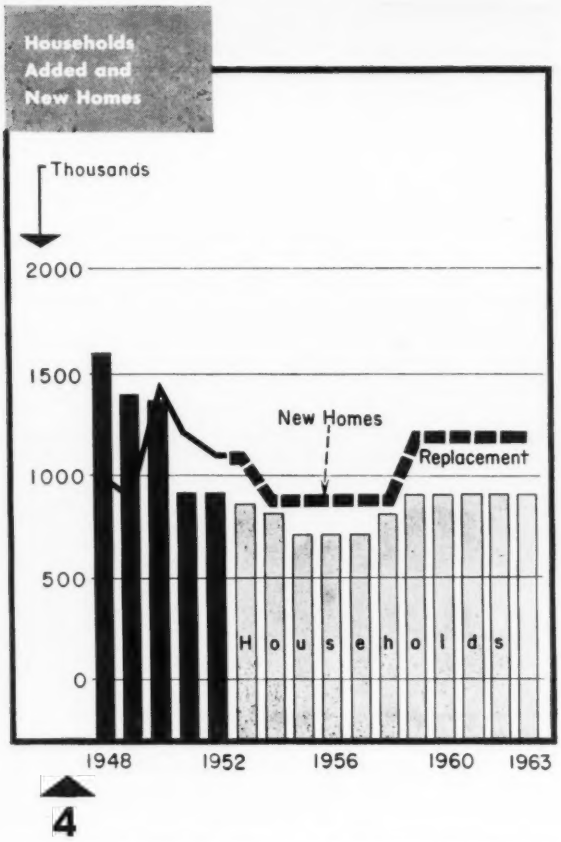
Many authorities feel that the rates for residential customers are far too low and do not reflect the cost of service to this class of business. We have therefore assumed a continuing increase in the rates to residential customers over the next few years with the average rate per customer leveling off at about 2.35¢ in 1963. This estimate also takes into consideration numerous studies indicating that heavy uses of electricity must be sold at rates near this level in order to be compensatory. Total revenue in 1953 is estimated at $2.62 billion and $2.84 billion in 1954.

Forecasting Residential Use Difficult . . . The annual increase in use of residential customers has long defied the forecaster. During the period such as the last World War the average use per residential customer continued to rise even when there were no appliances available. There were no tools with which to measure or evaluate this situation. Even now with the lack of available local data on consumer income and appliance purchases, it is very difficult to forecast residential use with any accuracy.

But when forecasting for the country as a whole, we find that several tools are available to reduce the guesswork to some kind of a science.

In Chart 4 we find the ten year estimates for new households. This is the key to the customers to be added to the power systems. On Chart 5 the number of estimated residential customers is plotted with total households. The difference between these two curves represents the number of non-electric homes and the master metered apartments along with the multi-home families.

In 1952 there was an average of .88 customers per household. This had increased from about .73 customers per household ten years ago. Because of the completion of home electrification in rural areas, the decrease in master metered apartments, and an estimated increase in non-occupied residential units, it is predicted that customers per household will increase to .965 by 1963.



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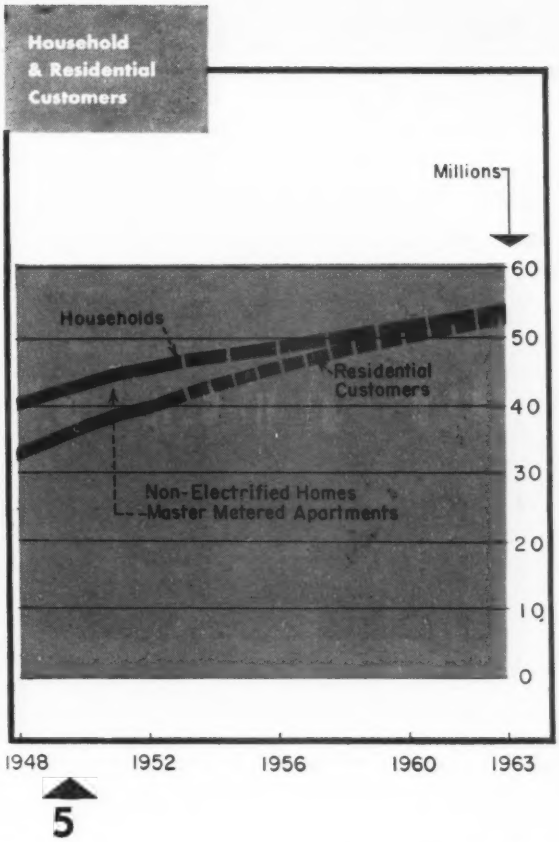

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Just 2% More Customers a Year . . . Applying these ratios, we arrive at the number of residential customers by years. The increase in family formations is on the decrease, and new residential customers follow the same trend. There will be about 1.3 million added customers in 1953, 1.2 million in 1954 and an average of 1.1 million for the remainder of the ten-year period. This will represent an average increase in new customers of only 2% per year. Obviously this will account for very little of the annual growth in this category of use.

Increase in the use of electricity by the family must come in the main from the purchase of new appliances. Compared with only seven years ago there are at least ten important appliance and other uses such as year-round air conditioning providing the stimulus for increase in the use of electricity per customer. This situation along with the increased purchasing power of the consumer from $132 billion in 1943 to $248 billion in 1953 and an estimated $310 billion by 1963 provides the answer to this problem. Customers will be able to buy the appliances from their discretionary funds.

Appliance Operating Cost Is Low . . . For the average appliance, it would take from ten to fifty years for its electric bill for operation to equal its original cost. For this reason the electric rates will not be a major factor in the picture except when year round air conditioning is involved.

We have therefore relied heavily on the forecasts for appliance sales in arriving at the estimated growth in energy use by the residential customer. Our estimates of sales of

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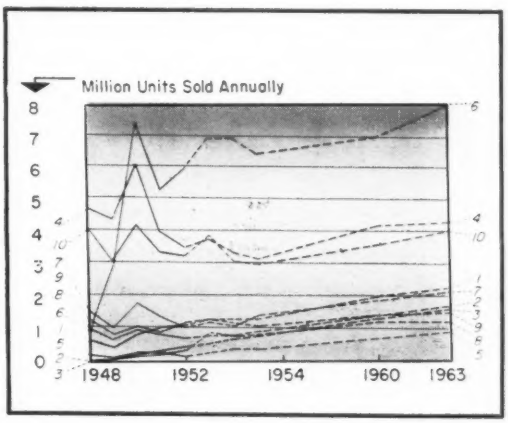
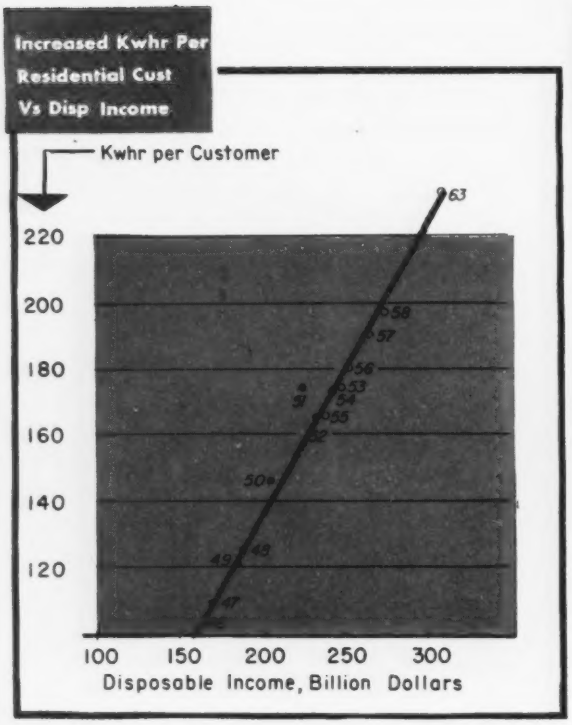


Key
1. Home Food Freezers
2. Room Air Conditioners
3. Clothes Dryers
4. Refrigerators
5. Dishwashers
6. TV Receivers
7. Ranges
8. Water Heaters
9. Space Heaters
10. Clothes Washers



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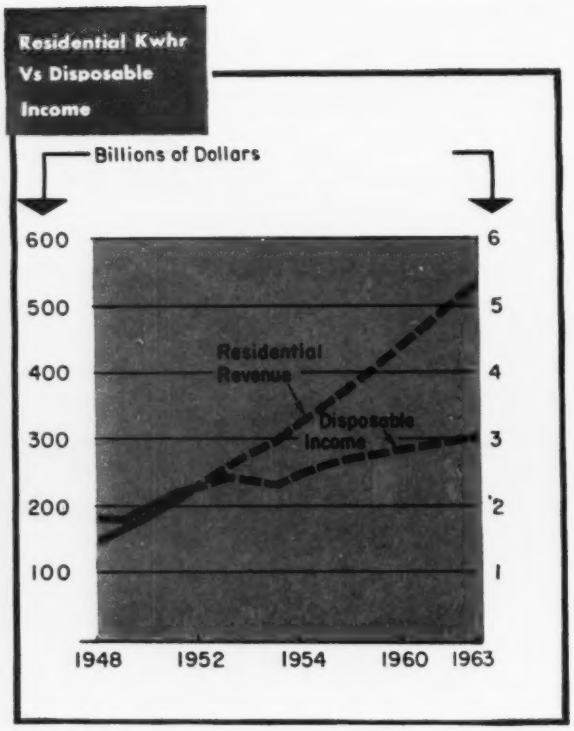

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electric appliances in Chart 6 are based to some degree upon the averages of the estimates of manufacturers of this equipment. Details of these estimates were presented in the May 18, 1953 issue of Electrical World.

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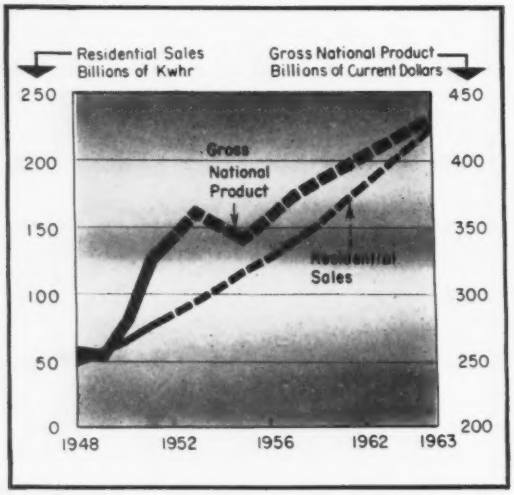


Even though the cost of electricity has little importance in terms of the purchases of power consuming apparatus, we do believe that there is a limit to what people will spend for this service. In 1952 the average residential customer bill was just 1% of consumers' disposable income. It has been over ten years since this much of the family income was spent for electricity. But at that time a much lower percentage of residences had electric service. We believe that the acceptance of the necessity of electric living will cause the average householder to spend 1.71% of his disposable income for electricity by 1963. There seems ample room for this gain just from reduced taxes and higher incomes.

Residential Use Versus Disposable Income . . . As pointed out above, it has been difficult to estimate the annual gain in use of electricity per customer. In our analysis of the recent trend we have found a close correlation between the annual increase in use per customer and disposable income as shown on Chart 7. We used this relationship to arrive at the annual increase in residential use up to 1963. Obviously this assumes a continued disposition on the part of the consumer to buy electrical appliances in somewhat the same pattern as today in terms of income available for this purpose. It would seem that this would be conservative as it is based upon the appliances in use today. The estimates have also been roughly verified by calculating the annual consumption of electricity of the appliances assumed to be sold in the next ten years.

The total annual use per residential customer is shown on Chart 10. It will be noted that the use per customer increases from an estimated 2,343 kwhr in 1953 to 4,326 kwhr in 1963, the annual increases being taken from Chart 10 based on the disposable incomes in Table I. We are predicting that the increase per residential customer will be 174 kwhr in 1953, equalling the previous record established in 1951. In 1963 this annual increase should be up to 230 kwhr per year based on a disposable income of $310 billion.

Total residential sales based on the average use in Chart 10 and the customers shown in Chart 5 are shown on Chart 9. Total residential sales were 86.8 billion kwhr in 1952. They will reach 97 billion kwhr in 1953 and 226 billion kwhr in 1963. The annual increase currently experienced of around 10 billion kwhr is predicted to continue with slight gains in both 1954 and 1955. Of course, the increase in 1954 is predicted upon the heavy sales of electrical appliances this year.

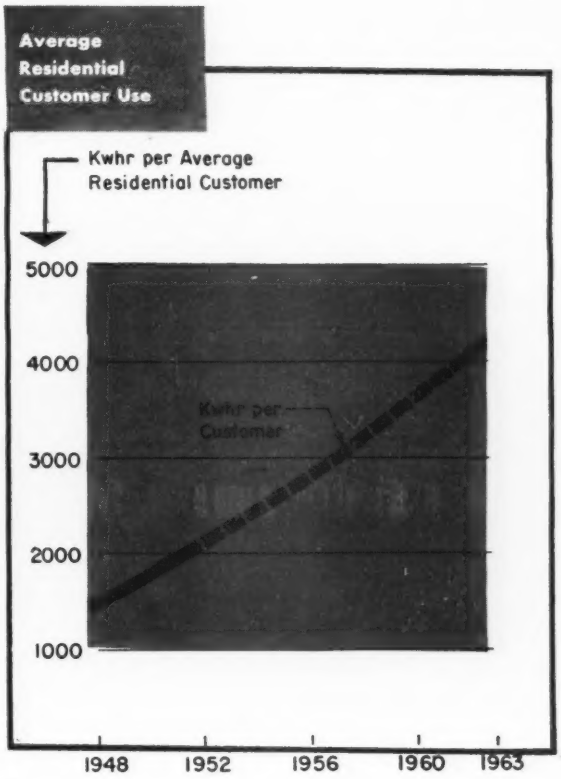
The residential revenue shown on Chart 8 represents a composite of the estimated customers and use per customer at average energy rates shown on Chart 11. In total the revenue from residential customers is estimated at $2.6 billion in 1953 compared with $2.4 billion in 1952. This amounts to 1.05% of the consumer disposable income in 1953. For 1963 we predict residential revenues of $5.3 billion amounting to 1.71% of the consumer disposable income.

Rates For Electric Service . . . The difficulty of arriving at a reasonable estimate of the average rate per kwhr for residential service is obvious. In order to establish the effect of increased use per customer, we deducted the known increase in electric rates in dollars secured over the past few years and developed a trend line on Chart 11 showing the reduction in average rates that would be expected as rates existed in 1947. From that line we determined that should rates have remained as they were in that year, the average rate per customer in 1963 of 4,326 kwhr per year would have dropped just below 2¢. However, the trend line of average costs assuming a continuation of rate increases levels off at about 2.35¢ per kwhr at 350 kwhr per month or 4,200 kwhr per year.

As pointed out above, we believe that an average price of 2.35 cents per kwhr will support the cost of service to residential customers for the all-electric home. It should be emphasized, however, that we have used 1953 dollars throughout. If the value of the dollar decreases further in the next ten years, we would expect rates to increase correspondingly.

Residential Customers Percentage Grows . . . In 1953 residential sales will represent 25.5% of the total compared with 15.4% ten years ago. Estimates for 1963 indicate that this class will grow to 29.6% of the total. This gain will be both at the expense of small and large light and power.

In terms of revenue, we find somewhat of a difference in the picture. Ten years ago residential accounted for 33.4% of the total for all classes of business. Today it has grown to 39%. However, our estimates for 1963 show only 40% of the total revenue being attributed to residential. Perhaps this can be explained by pointing out that increased use at lower incremental rates will be one of the predominant factors. One other significant contribution may arise from the continued federal preference for residential and rural customers.



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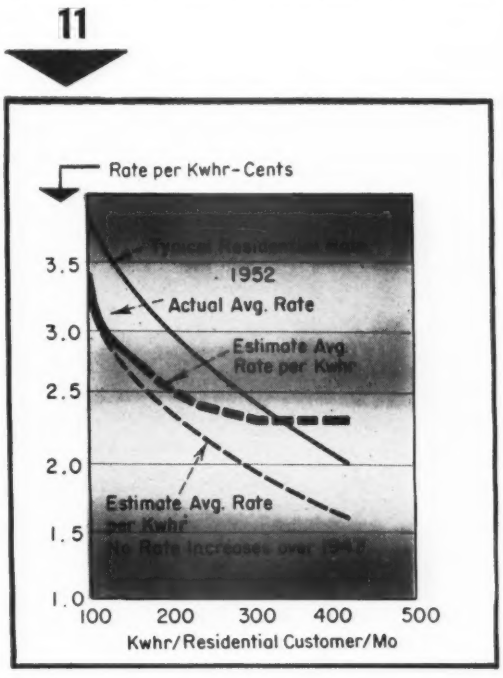

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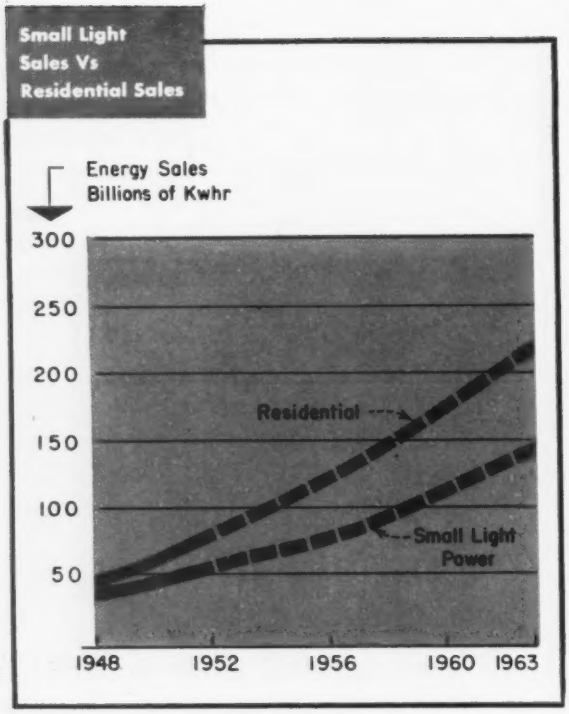

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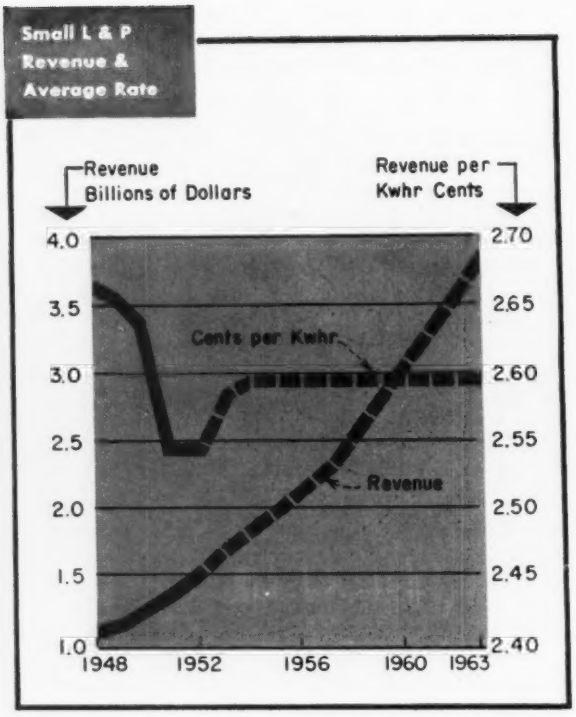

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Small Light and Power Sales

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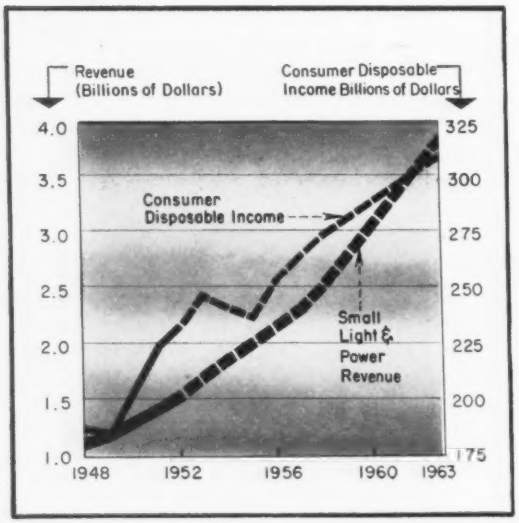

The parallel trend of residential and small light and power sales of electricity is expected to diverge in the next ten years

Prior to the end of World War II the small light and power and residential use of electricity had been parallel for a number of years. Beginning, however, in 1945 residential use began to pull away from the small light and power at quite a rapid rate. As shown on Chart 12, it is expected that this trend will continue and that the small light and power class of customer will grow more slowly. It is estimated that sales for 1953 in this class will be 68 billion kwhr compared with 62.1 billion in 1952. This growth of some 6 billion kwhr corresponds closely to that of the past couple of years. For the near term we predict similar increases for 1954 and 1955. This forecast is based on sales per customer of 12,000 kwhr in 1953 and 12,700 kwhr per customer in 1954 compared with 11,123 kwhr per customer in 1952. For 1963 we are predicting a total of 22,600 kwhr per customer.

A Gain of 100,000 a Year . . . Over the past ten years

the small light and power customers have maintained an average ratio of .12 to the number of family units. It is estimated that this ratio will be maintained over the next ten years, and the estimated customers are based on this assumption. Small light and power customers will rise from 5.7 million in 1953 to 6.6 million in 1963 or an average gain of approximately 100,000 per year as shown in Table II.

The average rates paid by the small light and power class (Chart 13) decreased rapidly until 1951 to about 2.55¢ per kwhr. This trend has recently been reversed because of necessary rate increases. It is predicted that they will level at about 2.6¢ for the foreseeable future. Total revenues from this class of business are forecast to increase from $1.58 billion in 1952 to $1.76 billion in 1953, $1.91 billion in 1954, and $3.9 billion in 1963.

One More Check on the Forecast . . . In view of the close relationship between consumer expenditures and commercial business we have plotted in Chart 14 the relationship of small light and power revenue to the consumer disposable income. The correlation was not close, but it does give an additional check on the validity of these forecasts.

Primary area for load growth in the small light and power group seems to be in the field of air conditioning, lighting, electric cooking, electric laundry, and water heating. Perhaps the character of the load growth in this group will depend primarily upon the extent to which air conditioning is installed in the period ahead. This will in turn depend upon the ability of the industry to sell wiring modernization to commercial building owners and occupants.

Other Uses Important Also . . . But the other uses of electricity mentioned are not to be ignored. Many of these require appliances or fixtures which can be installed for a relatively small cash outlay. Yet they provide a steady, all-year-round demand for electric energy.

As pointed out in a feature article in the March 23, 1953 issue of Electrical World, commercial electric cooking provides a great opportunity for load growth. It includes not only public eating places, but institutions such as schools, hospitals and industrial plants.

Claud Wompler, president, Carrier Corporation, pointed out recently that in 1952 "the air conditioning industry rounded the acceptance corner and was confronted with a demand that appeared to be almost unlimited." Wompler predicted a total air conditioning business of $5 billion by 1963. If the small light and power customer represents one-fourth of this market, it will have a major effect upon the load growth and revenue production of this group.

In 1953, the small light and power customers provide 26.2% of the revenue from only 17.8% of the kwhr sales. We predict that this revenue will rise to 29.7% of the total while sales grow to 19.6%.

The instability in the classification of small light and power customers makes predictions rather unreliable. Obviously some of the growth represented by this group will move into the large light and power classification. In the past it has been found that small light and power remains as a relatively constant percent of the total. Perhaps the increase we show represents the conversion that will take place to the other group.

Miscellaneous Power Sales

Rapid gains in strictly rural and street lighting business will cause miscellaneous power sales to grow rapidly

For purposes of convenience and more accurate comparisons the sales of power at rural rates have been included along with street lighting, other public authorities, railways and railroads in the miscellaneous categories. Sales to distinct rural customers are expected to gain some 50% over the next ten years. This same increase is predicted for public authorities. But street lighting should gain momentum and double in the next decade. It is assumed that use by railways will continue to decrease gradually at is has in the recent past. A change in the economics of railway electrification would radically alter this picture.

Total revenue from this class of business amounted to some $450 million in 1952 at an average rate of 1.71¢. We predict that the rates will remain approximately the same over the next ten years during which sales will increase from 27 billion kwhr in 1953 to 38 billion in 1963. This will give total revenue of $461 million in 1953 and $645 million in 1963.

In 1953 this group accounts for only 7% of the total revenue. It appears that they will be no more than 5% by 1963 due primarily to lack of growth in electrification of railroads. An adequate return on street lighting service would also increase the estimates of revenue from this customer group.

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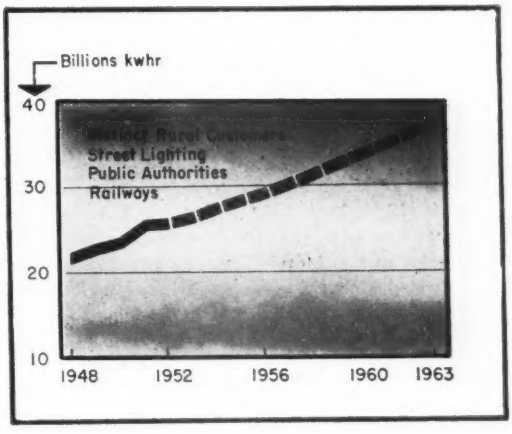

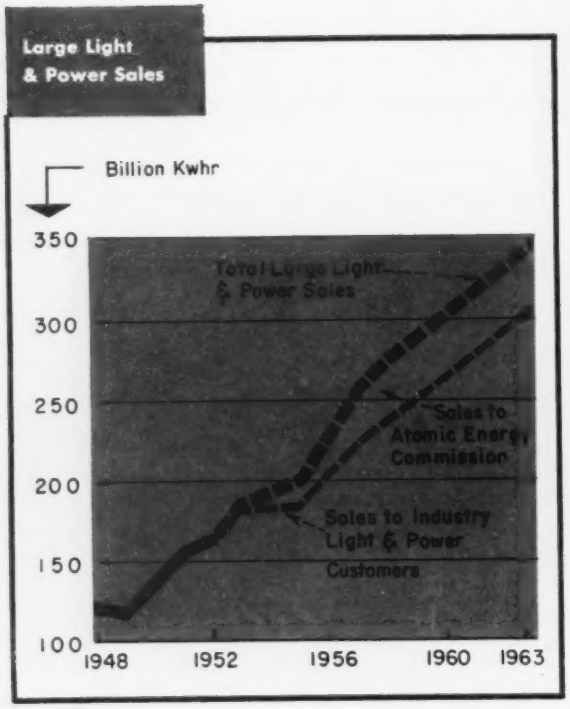

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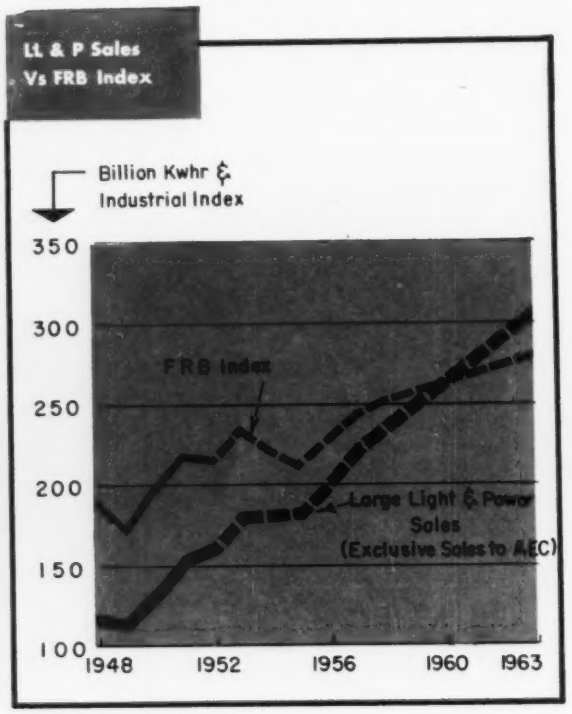

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Large Light and Power Sales Up

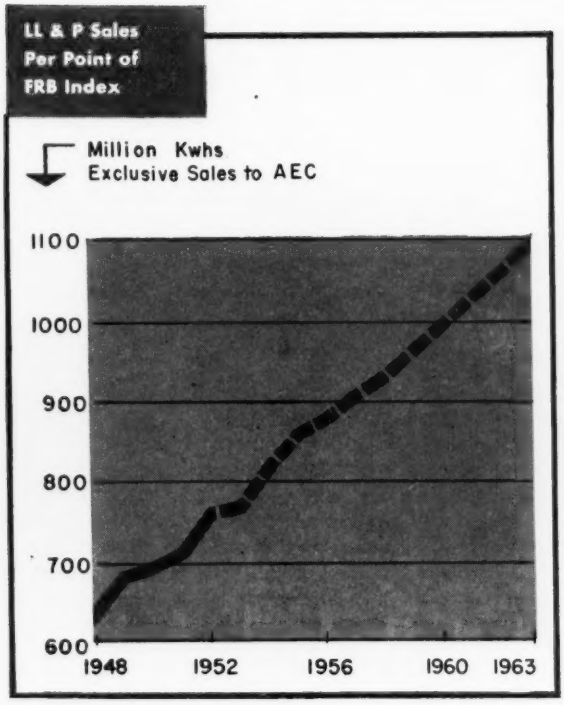
Drop in Industrial Index not expected to cause decrease in large light and power sales because of compensating effect of sales to AEC. This latter item to reach 50 billion kwhr

Perhaps the most uncertain element in the economic forecast over the next few years is to be found in the predicted industrial production. As shown in Table I the McGraw-Hill Department of Economics has estimated a decrease in the Industrial Index from the present level of around 240 to an average of 223 in 1954 and 215 in 1955. Others have been more pessimistic taking the index down to around 200 some time in 1955.

We are predicting that the large light and power sales will make a record increase of about 22 billion kwhr in 1953. In spite of the decrease in industrial production expected in 1954, large light and power sales will again increase because of a predicted growth of some 11 billion kwhr in sales to the Atomic Energy Commission installations. Over the next few years we are predicting sales to AEC installations will increase to 40 billion kwhr, but this is on a conservative basis. Perhaps 50 billion kwhr would be nearer the ultimate. The total sales for this class of business are shown in Chart 16. Chart 17 shows a trend relative to the Federal Reserve Index of industrial production. It will be noted that the decrease in the index is not expected to cause large light and power sales, exclusive of sales to AEC, to drop below present levels. This will be explained further below.

Industrial Power Rates May Be Cut . . . For a number of years the revenue from the sales of power to large light and power customers has been kept fairly well in line with the cost of service. This has been due to the almost universal inclusion of fuel clauses in the rate schedules. In 1953 the average rate per kwhr was around 1¢ as it has been for some time. However, we believe that this will decrease over the next few years because of the high volume and high load factor sales to the Atomic Energy Commission installations. Total revenue for large light and power are shown on Chart 19.

Since 1948 the kwhr consumed per point of the Industrial Index has been increasing at a steady rate of approximately 3% per year as shown on Chart 18. This rate of increase is assumed to be maintained annually over the



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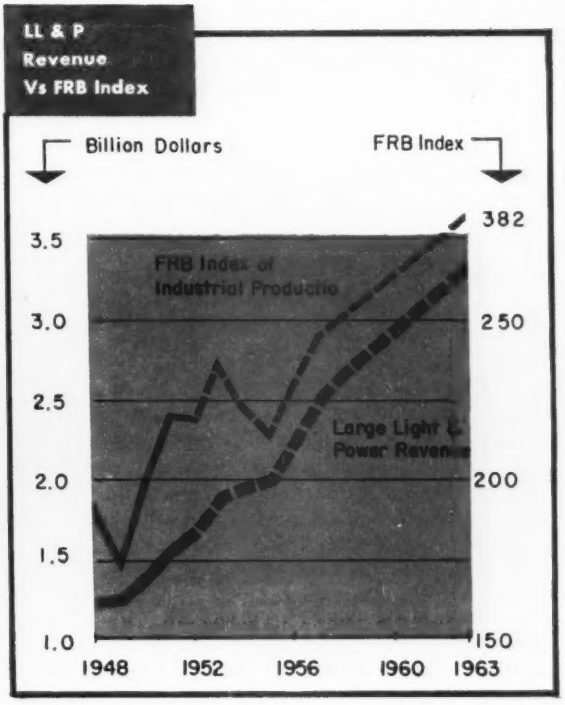

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ten-year period covered by this forecast. We have also found by studies of recent historical records that a drop in the Industrial Index does not cause a corresponding decrease in the use of power by industry. The principal factor in this situation is probably the existence of a base power requirement regardless of the amount of production. In Chart 20 we have shown an evaluation of this situation wherein we have plotted the average increase in large light and power sales per point of decrease in the Federal Reserve Index.

Index Down, Use Per Point Up . . . In other words we have found that a decrease of 10 points in the Federal Reserve Board Index will cause a monthly increase of 2 billion kwhr per point of index. Using this data along with the average increase in the use of energy due to technology, we arrive at our forecast for total large light and power sales. For instance, in 1954 we predict a use of 842 million of kwhr per point of the Industrial Index compared with 787 million kwhr per point in 1953. Thirty-one million kwhr of the per point change is due to the drop in the Index and 24 million kwhr is due to the normal increase in use of electricity by industry. Obviously over a period of years these ratios will change, but we believe them of sufficient accuracy to develop our trends to relate large light and power sales to the Federal Reserve Board Index.

Use Per Manhour Must Increase . . . An important contribution to the subject of industrial power use was published in the June 8, 1953 issue of Electrical World. This material presented by D. C. Hooper of Westinghouse Electric Corp, develops curves for the necessary increase in power consumption for increases in the FRB Index of Industrial Production. To reach an Index of 269 by 1962 he predicts the need for using 12.5 kwhr per man-hour. His forecasts for use of energy by individual industries also worthy of careful study by those interested in this subject.

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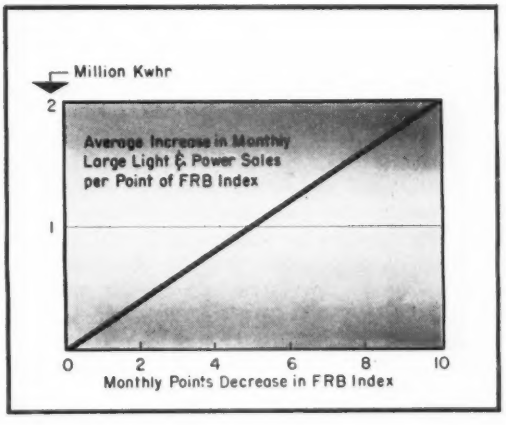


Capital Expenditures to Peak in 1954

A continued increase in annual generating station capacity additions along with heavy growth in peak loads will require increased capital expenditures in 1954

Accurate statistics on capital expenditures of electric utilities have been available for many years through the surveys conducted by Electrical World. However, until recently, expenditures by electric co-ops and governmental agencies have not been as accurate as desirable. In Table III we have developed approximations beginning in 1948 for capital expenditures of all classes of electric utilities.

As reported in the Annual Statistical Issue of Electrical World (Jan. 26), it is expected that expenditures will run to approximately $4.2 billion in 1953. In 1954 the generation and transmission facilities installed should be more than 10% above 1953. This is reflected in the figures shown in the table. The stimulus of power facilities being installed, the Ohio Valley Electric Co, Electric Energy, Inc, and Tennessee Valley Authority for service to the Atomic Energy Commission installations is, of course, an important factor in this peak. Of course, the necessary interconnecting transmission lines to back up the power supply and provide outlet capacity from the generating stations cause a corresponding trend in this category.

Distribution Facilities Needed . . . Because of the heavy load growth reported by residential customers during 1953, we might expect substantial increases in distribution system outlays in 1954. In fact we may be too conservative in predicting only a minor increase in expenditures in 1954 for this part of the electric system. However, it is expected that the number of customers added will decrease by approximately 100,000 thereby reducing requirements for line extensions. On the other hand, a continuing need for modernization to improve voltage regulation along with continuity of service will require substantial outlays for a long time to come.

Looking at the period beyond 1954, it is expected that non-simultaneous peak loads of all power systems will increase 8 or 9 million kw per year. This will require annual increases of generating capacity and other system facilities of approximately the same dollar amounts for each of those next 10 years. As shown in Table III we expect capital expenditures to reach $4.5 billion in 1954 and remain at this level through 1955. It is probable that some dropoff will be experienced in 1956 when the current capacity addition program will have been completed. However, by 1963 the annual level of expenditures should be up 50% above today in the realm of $6.4 billion.

How Much Will Government Spend? . . . One of the uncertain factors in the estimates of expenditures relates to the plans for governmental developments. Certainly the installation of subsidized power stations by the federal government permitting power to be sold below cost is a real stimulant to the use of electrical energy. It is our view, however, that this will be less of a factor in the future and that the activities of the federal government will have little effect upon the forecasts for load growth and capacity additions. Should the TVA be unable to secure Congressional funds to supply power to the large municipalities in Tennessee, they will undoubtedly find other sources of equal amounts at relatively equal cost. Over the next ten-year period the demand for energy will be so heavy as to require the construction of many more hydro-electric plants that may not have been feasible in the past. This we believe will take place even if unforeseen progress is made in the field of nuclear power. The estimates for capital expenditures should be ample to cover these possibilities.

Electric Co-ops To Grow . . . Available information would indicate that electric co-ops are spending around $115 million for capital additions in 1953. Due to the rapid growth in rural areas expected over the period ahead, we predict a material increase in their expenditures.

TABLE III—SUMMARY ESTIMATED CAPITAL EXPENDITURES ALL AGENCIES—Million Dollars

	Generation	Transmission	Distribution	General Plant	Total
1948	$1,103	$400	$1,278	$ 84	$2,865
49	1,410	400	1,457	93	3,360
50	1,275	425	1,333	109	3,142
51	1,344	504	1,172	131	3,151
52	1,925	577	1,118	118	3,738
53	2,174	666	1,198	145	4,183
54	2,383	750	1,215	138	4,486
55	2,462	740	1,220	140	4,562
56	1,980	570	1,170	137	3,857
57	2,300	690	1,330	153	4,473
58	2,160	650	1,590	180	4,580
63	2,665	800	2,620	287	6,372

Utililty Earnings Will Be Maintained in the Next Recession

Increasing residential and commercial revenues along with improved financial stability and cushioning effect of high operating ratio will keep income high.

C. P. GUERCKEN, Assistant to Financial Vice President, Ebasco Services, Inc, New York, N. Y.

A recession even as severe as that encountered in 1937 and 1938 will have a minor effect upon electric utility income. This is the general conclusion based upon a comprehensive study summarized in this article. The prospects for maintenance of earnings and dividends are good because of the following:

1. The increased operating ratio (including taxes and depreciation) means that the loss to income has already been sustained. Consequently, a substantial cushioning effect will be available if revenues decline.

2. The relationship of industrial revenues to costs of generation is such and differs so materially from the situation existing in the past that a decline in business activity would have a negligible effect on net income.

3. The strengthened equity position of the industry is such that even considerable reductions in net income, providing they are not over too long a period, can be compensated by an increased (in percentage) payout. Consequently, there will be little or no decline in dividends paid.

Conclusions

An economic recession will only cause a slowing down of the financial rate of growth of electric power companies because:

1. Substantial amounts of old and inefficient plant are still being used because of the tightness of capacity. The reduction of output from this plant will have a beneficial effect on income.

2. The lessened spread between the average price of large industrial power per kwhr and the cost of fuel. Consequently any decrease in industrial activity would not be felt as severely as was the case at the start of the great depression.

3. The improved financial condition of the industry with respect to coverages of fixed charges and preferred dividend requirements.

4. The higher operating ratio and tremendously increased taxes would tend to cushion any decrease in revenues to a greater extent than in the past.

5. The improved stability of load served by the industry because of the greater percentage of residential revenues to the total as compared to conditions ruling in the twenties and early thirties.

6. The greater value of service today as compared to the past.

Effect on Kilowatthour Sales

Industrial . . . During the 1937-38 recession the industrial sales classification showed a decline of some 16%, and by 1939 the total industrial kwhr sales were nearly back to the 1937 level. On the basis of a 1937-38 type recession on 1952 industrial sales the loss in sales would amount to 23 billion out of a total of 142 billion kwhr.

The loss in revenue would not be in proportion to sales. On the basis of an average industrial rate of 1¢ per kwhr in 1952, the incremental loss in revenue would be at the rate of 0.78¢ per kwhr. The total annual loss in revenue would then amount to $178 million.

In 1952 the average coal rate was 1.1 lb per kwhr generated, and the cost was 0.343¢ per kwhr. It is believed that the back-off rate would be 15% higher than the average of 0.394¢ per kwhr assuming constant fuel costs. In 1937 the average fuel cost of production was 0.231¢ per kwhr. The incremental back-off rate amounted to 0.278¢ or 25% above the 1937 average.

To cover other economies expected in case of a reduction in generation for industrial sales an overall reduction of 0.42¢ per kwhr is estimated for '52 conditions.

The assumed reduction of industrial kwhr was 22.8 billion which is equivalent to 24.6 billion kwhr generated. On the basis of 0.42¢ per kwhr, the savings in production expense would amount to $103 million annually. The net loss in revenue before taxes would be $75 million and after taxes $36 million. This loss would amount to approximately 3.4% of the electric operating income of the private utilities based on 1952.

Residential Sales and Revenue . . . Neither the severe recession of 1937-38, the period of reconversion following the war, nor the rather mild recession of 1948-49 had any material effect upon the rate of growth of residential revenues. The rate of increase during the four years from 1937 through 1941, for residential revenues, amounted to $34 million per annum. The increase from 1937 to 1938 was $37 million or 9% higher than the average. The rate of increase in the postwar years amounted to approximately $150 million per annum while the actual increase from 1951 to 1952 was $185 million. An in-

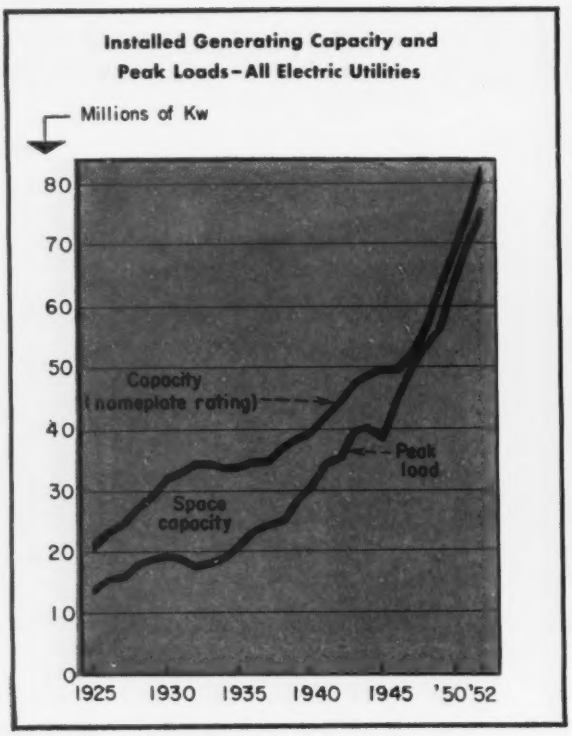


Chart 1

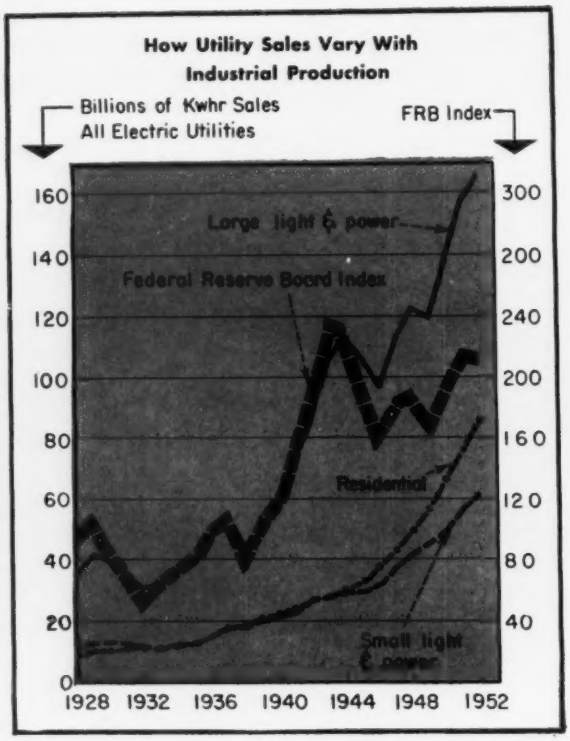


Chart 2

crease of $160 million per annum would appear to be reasonable in a period of recession.

Commercial Revenue . . . The commercial, small light and power, classification has shown exceptional revenue stability in the face of a recession. From 1933 through 1937 the average increase in revenue amounted to $33 million per annum. The recession of 1938 reduced this rate of increase to $15 million, or 2.6%. The postwar increase amounted to an average of $96 million per annum with an increase from 1951 through 1952 amounting to $101 million, or 7.5%.

The estimated small light and power revenues for the Class A and B private utilities have been estimated at $1.4 billion for 1952. Assuming a decline in business comparable to the 1937-1938 recession, a 2.5% increase in revenues would not appear to be unreasonable. This equivalent increase in revenues would then be $35 million during the period of recession.

As regards other revenues, this increase has been estimated at $20 million on the basis of 1937-1938.

The overall effect of the foregoing changes in operating revenues is a net increase of $37 million before taxes and, consequently, it would appear that within reasonable limits of accuracy there should be no decline in operating income and possibly a small gain.

Changed Conditions Since 1929

In 1930, approximately one year after the beginning of the great depression, the utility industry could look back on a period of tremendous expansion. In the ten years from 1920 to 1930, the utilities increased their total generation 51.7 billion kwhr or 131%; added some 13.7 millions of new customers, an increase of 127%; and installed 19.7 million kw of capacity, an increase of 155%. In the same period the non-coincident peaks of the utility industry increased only 11.1 million kw or 78%.

Substantial and far reaching changes took place in the physical operating characteristics of the industry during the next 23 years. Not only did plant become much more reliable, but pooling and interconnections spread to a large part of the industry. Both these factors had the effect of reducing the needed number of "spares." The industry nearly doubled its capacity and more than trebled its output. In 1929 with a total capacity of 29.8 million kw there was 10.6 million kw of spare plant. By 1952 the industry had 82.1 million kw of capacity and only 6.7 million kw of spare and reserve plant.

In 1929 the percent of spare plant to peak was 55%; by 1952 there was only 9%. On Chart 1 it will be seen that the tightest demand condition occurred in 1948 when the amount of spare plant fell to 5% of peak. While the situation eased to 11% in 1949, no substantial amount of spare capacity will be available until the fall of 1955.

A further interesting point is revealed by the fact that from 1920 to 1930 capacity increased 19.7 million kw as compared to 11.1 million kw of system peak demand. From 1942 to 1952, however, the position was reversed. While the increase in capacity amounted to 37.1 million kw, peak demand increased 39.6 million kw. This condition indicated not only the tremendous expansion of the utility business but also better utilization of capacity through interconnection, the use of more reliable equipment, better operating techniques, etc.

Another factor is the marked increase in plant utilization as witnessed by the increase in plant factor (kwhr per kw of capacity). The plant factor amounted to 35.7% in 1929

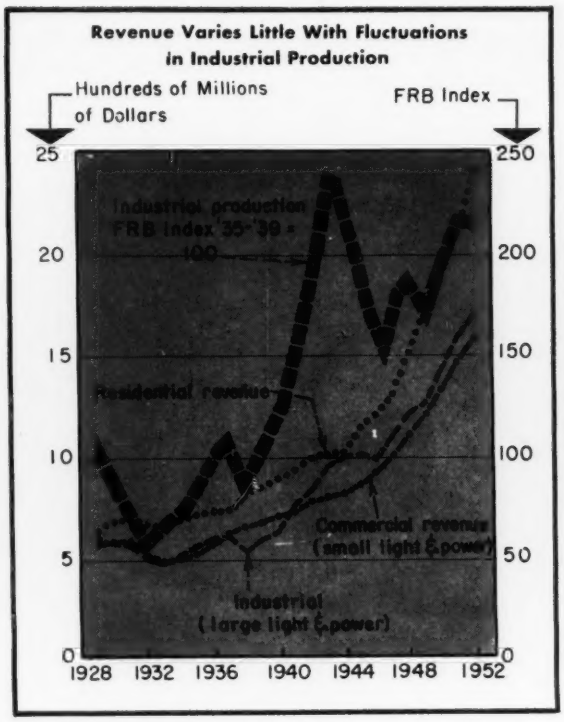


Chart 3

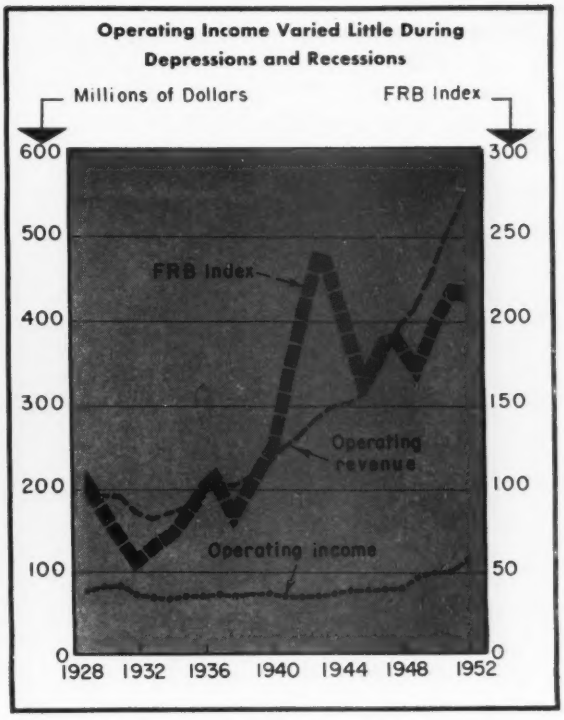


Chart 4

and then dropped to 32.9% in 1930. In 1942, under the impact of war production, it stood at 48.5%, but by 1952 it had risen to 55.5%.

Effect of the Depression on Kwhr Sales

The relationship of the Federal Reserve Board Index of Industrial Production on the various classifications of kwhr sales is shown in Chart 2.

The significant features of the trend are the comparatively small variations of kwhr sales with declines in the FRB Index and the lagging declines of large light and power followed by the small light and power classification. The decline in residential sales was so minute that no comment or analysis is justified.

The maximum loss of production as measured by the index amounted to 47.3% while the maximum declines for large light and power and small light and power sales amounted to 28% and 17% respectively. In 1932 industrial sales were coincident with the low point of the FRB Index while the low point for small light and power sales was reached in 1933. As regards the beginning of the decline, large light and power sales began to drop in 1930 while small light and power sales started to fall in 1931.

The duration of these declines also varied. Thus the time from the first year of decline to the first year of "upturn" varied from four years for large light and power and three years for small light and power sales.

In the business recession of 1937-1938 industrial kwhr sales as reflected by the large light and power classification declined for one year and then resumed their upward climb. In this instance the decline was proportionate to the decline in the FRB Index. There was only a slight decrease in the rate of growth for residential and small light and power sales.

In 1944, the FRB Index began a precipitous decline which did not end until 1946 when postwar reconversion was completed. Large light and power sales fell only 14% while the FRB Index declined 27.7%, nearly double the decline in kwhr sold. As an offset to this decrease, small light and power and residential kwhr sales increased at an even faster rate than heretofore.

Effect of Depression on Revenues

As for revenues, the general pattern of the depression is somewhat similar to the decline in kwhr sales (See Chart 3). Thus while the FRB Index dropped 47.3% from 1929 to 1932, large light and power revenues declined 21% from 1929 to 1933, small light and power 18% from 1930 to 1933, and residential 4.5% from 1931 to 1933. The reasons for the somewhat greater percentage decline in residential revenues than residential use, which amounted to only 1%, were two: First, the "doubling up" of families had the effect of reducing the number of customers and, consequently, the number of low use bills. Secondly, the rate reductions at that time began to make themselves felt.

Again there was a "staggering" in the decline in revenues. The large light and power classification began to decline in 1930, the small light and power in 1931, and the residential in 1932. The result was that the over-all decline in total revenues amounted only to 13.5% from the peak.

In 1937 the decline was reflected only in large light and power revenues; but, as will be seen from Chart 3, the growth of small light and power and residential classi-

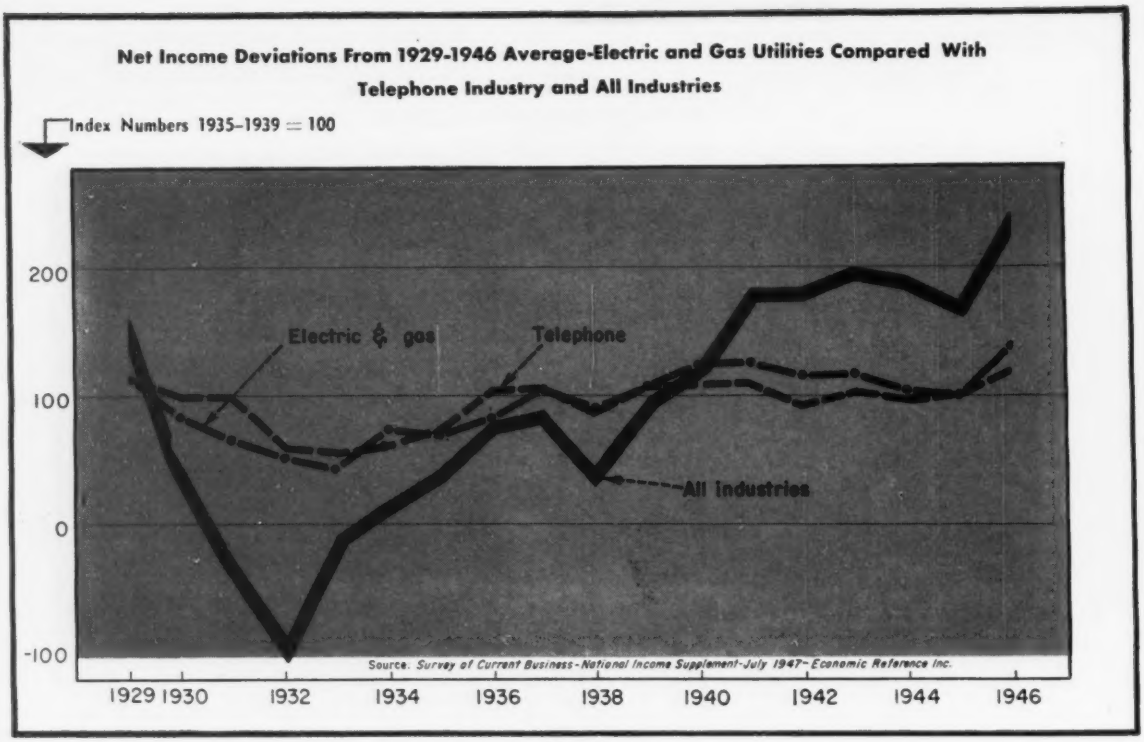

Net Income Deviations From 1929-1946 Average-Electric and Gas Utilities Compared With Telephone Industry and All Industries
Index Numbers 1935–1939 = 100
200
100
0
-100
Electric & gas
Telephone
All Industries
Source: Survey of Current Business-National Income Supplement-July 1947-Economic Reference Inc.
1929 1930 1932 1934 1936 1938 1940 1942 1944 1946

Chart 5

fications was such only a fractional decline in total revenues was registered.

In 1944-1946 while the FRB Index declined 27.7%, large light and power revenues dropped 7.2%. Small light and power and residential revenues registered major gains during this period. It should be noted that the decline in large light and power kwhr sales amounted to 14%, or nearly double the decline in revenues.

Finally, one other feature deserves particular comment in any analysis of revenue stability; namely, percent participation in total revenues of the residential classification. In 1927, just two years prior to the depression, the participation of residential revenues to total stood at 28.0% while by 1952 the participation had risen to 35.1%, an absolute change of 7.1%.

Effect of the Depression on Income

On Chart 4 is shown the effect of two depressions and the period of reconversion on the operating revenue and operating income of the private electric utility industry. While the FRB Index declined 47.3% from 1929 to 1932, revenues experienced their maximum decline of only 13.5% from 1930 to 1933. While electric operating income fell 20% from 1931 to 1934 and revenues declined $254 million, operating income was only $163 million less than the peak.

In the face of falling demands and of a general economic depression the industry proceeded to spend substantial funds in order to add to its capacity. Consequently, its depreciation accruals rose during this period. At the same time, there was a marked increase in federal income taxes. There was a decline of $91 million in operating revenue deductions while operating expenses fell $123 million. Had there been no increase in depreciation and taxes, the decline in operating income would have been only $131 million instead of $163 million, which actually took place. Of the $123 million decline in operating expenses 27% came from reductions in fuel costs and the remainder from less or cheaper labor, materials, and supplies, etc.

From 1937 to 1938 the FRB Index experienced a drop of 21.2% while the effect on operating revenues amounted to only 0.6%. The consequent decline on operating income was negligible.

In the reconversion period of 1944 through 1946 the index dropped 45 points, 27.7%, while at the same time operating revenues increased 6% and operating income 6.2%. Because of substantial refinancing in this period, net income rose 26%. The reason for this exceptional showing, as was previously explained, was due primarily to the very large increase in residential revenues which more than made up for the decline in the large light and power classification.

Before concluding this section of the report, it is of interest to consider the relative resistance of the net income originating in utilities, telephone companies, and manufacturing companies to an industrial depression. On Chart 5 are shown the net incomes in index form (1935-1939 = 100) for the three major industries over the 20-year period from 1929 to 1946. From this chart it will be seen that from the aspect of stability and resistance to depression the electric utility industry is outstanding.

On an over-all index of stability based on the coefficient of variation, it will be seen that this coefficient stands at 12.7% for electric utilities, 17.4% for telephone and 49.7% for industrial companies. In other words, on a relative basis the electric utilities are 1.4 times as stable as the telephone and 3.9 times as stable as the industrial group.

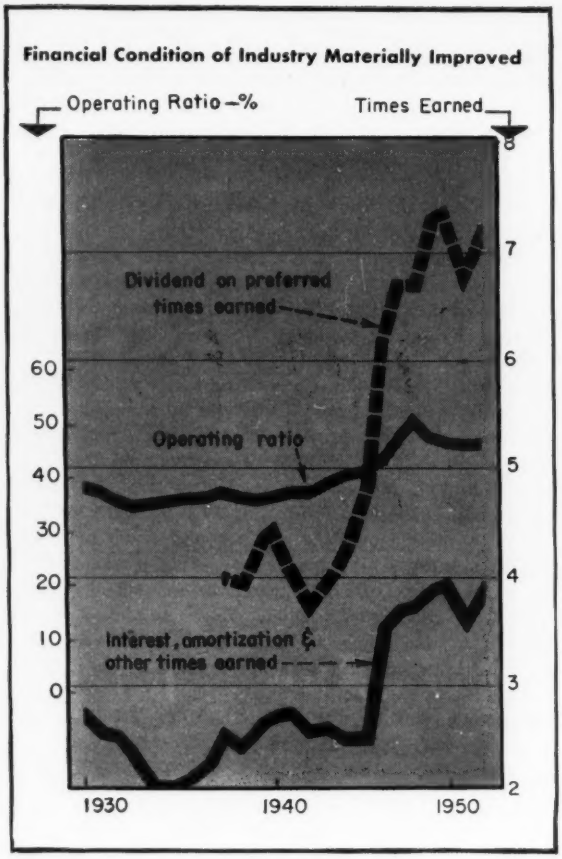


Chart 6

Improvement in Financial Conditions

Since the end of the war, well-founded concern has been expressed over the steady rise of expenses in the electric utility industry and the general tendency towards rigidity in the utility cost structure. There is no question that utility earnings are too low in relation to other segments of American industry and should be raised substantially. On the other hand, the introduction of new and more efficient plant, an expanding market, and improved relations with regulatory commissions are having a beneficial effect on net income.

The operating ratio fell from 1926 onwards and reached a low point of 36% in 1932. From then, as is shown on Chart 6, the rise has been steadily upwards, reaching a peak of 52% in 1948 and then declining, principally because of technological improvements, to 47.5% in 1952. Without analyzing in detail the reasons for this increase, it can be said that the rise in the cost of fuel was one of the prime factors, as witnessed by the fact that this item of expense approximately doubled in the last 23 years. While payroll has gone up substantially within recent years, the percent of payroll to operating revenue in 1952 was fractionally less than for 1929.

As regards other operating revenue deductions, depreciation increased from 8.42% of operating revenues in 1929 to 9.45% in 1952, or a relative rise of 12.5%. Taxes, both federal and local, showed a tremendous rise during this period. From 1929 to 1952 they increased more than two and one-third times in terms of operating revenues, while the federal income tax rate rose from 11% of the net taxable income in 1929 to 52% in 1952. Over all then there was a very large rise in operating revenue deductions during the 24 year period. This was one of the reasons why a decreasing percentage of operating revenue has passed through to electric operating income.

However, it is important to recognize that while a high operating ratio is a hindrance to a utility whose revenues are growing equally well, it has a substantial cushioning effect on operating income when revenues are declining. In the accompanying table is shown a comparative analysis of an equivalent decline of 20% under conditions of low operating ratio and high taxes. Furthermore, it has been assumed that only fuel costs, plus some minor variable expenses, will fall proportionately to revenue. Consequently, substantially higher operating ratios will be in effect after the reduction of revenues in each case.

Operating Statistics

	1929	1952
Operating Revenue	$1,000	$1,000
Operation Ratio % (Inc. Depreciation)	47.5%	57.1%
Operating Expense and Depreciation	$475.	$571.
Net from Operations (before Taxes)	$525.	$429.
Federal Income Tax Rate	11%	52%
Operating Income	$467.	$206.
Operating Revenue	$800.	$800.
Operating Ratio % (Inc. Depreciation)	56.3%	65.5%
Operating Expense and Depreciation	$450.	$525.
Net from Operations (before Taxes)	$350.	$275.
Federal Income Tax Rate	11%	52%
Operating Income	$312.	$132.
1—Decrease in Operating Revenue	$200.	$200.
2—Decrease in Net from Operations	$175.	$144.
3—Decrease in Operating Income	$155.	$ 74.
4—% Decrease in Operating Revenue	20%	20%
5—% 2 of 1 above	87.5%	72.0%
6—% 3 of 1 above	77.5%	37.0%

From the tabulation it will be seen that while a high operating ratio (including depreciation) and high taxes have reduced to less than half the operating income of a utility in 1952 as compared to 1929, the reverse is also true. Any decline is materially reduced with high operating expenses and taxes. Thus, with a $200 decrease in revenues in 1929, the utility suffered a decline of $175 in net from operations (before taxes) or 85.7% of operating revenues while the same reduction in 1952 amounted to only $144 or 72.0% of operating revenue. Similarly, the effect on operating income is even more pronounced. In 1929 a reduction of $200 resulted in a loss of $155 of operating income while in 1952 the same reduction in revenue resulted in a loss of only $74 or 37% of the operating revenue reduction compared to 77.5% of the earlier figure.

Financial Structure . . . Substantial alterations have taken place in the financial structure of the private electric utility industry during the last 20 years. All of the changes which have taken place have been in the direction of strengthening the equity position of the industry in these ways:

1. By the plow-back of approximately $2.1 billion of earnings from 1937 through 1952.

2. By the large reduction in fixed charges through the route of refinancing which has resulted in a substantial increase in number of times fixed charges are covered.

This is probably the most important of all the improvements noted and is shown in detail on Chart 6.

Coverage of Fixed Charges . . . It will be seen that in 1929 the coverage of fixed charges amounted to 2.7 times while by 1952 the figure had risen to 3.9 times, a relative increase of 45% in the coverage.

With the coming of the 1929 depression, the coverage fell from 2.7 times to 2.06 times, a decline of 24%. It is of interest to note that if the same decrease took place in 1952, the coverage would amount to 2.96 times which is 10% higher than the pre-depression maximum. Taking into account the previous analysis of operating ratios and the incidence of taxation, it is obvious that a comparable decline in business activity would not produce the same percentage decline in the fixed charge coverage as took place in the great depression.

Preferred Stock Coverage . . . The record is incomplete on preferred stock since data are available only from 1937. However, even in that period it will be seen from Chart 6 that a tremendous improvement has taken place in the coverage of preferred stock dividends. It shows an increase from 4 times in 1937 to 7.22 times in 1952 or a rise of 81% in the period. This has been due, principally, to a large growth in utility plant as compared to preferred stock capitalization.

Hidden Reserves . . . Another indication of the strengthened financial position of the private utilities, and one which is sometimes overlooked, is the nature of the so-called "hidden reserves" existing within the corporate structure of the industry. These "hidden reserves" are in the form of book debits to surplus (for accounting adjustments) over a period of years and which have resulted in a substantial understatement of the corporate cushion.

The earned surplus at the end of 1937 amounted to $802 million while by 1951 this had risen to $1,444 million, an increase of 80%. However, had these accounting adjustments not been made the balance in the surplus account would have stood at $2,694 million in 1951, an increase of $1,250 million over the amount actually shown per books. Fundamentally, what the foregoing means is that the value of the property is substantially understated; so real equity is higher than book figures indicate.

In addition, it has been estimated that the present program of accelerated amortization will provide something like $700 million over the next five years for the private electric utilities. At the moment of writing, it would appear from the action of some commissions, that the major portion of this amount would lodge in earned surplus (subject to restrictions as to dividends). However, even with these restrictions, and with no further additions to surplus through normal operations (a most unlikely eventuality), the earned surplus account by 1958 should amount to $2.3 billion, or, if taking into account normal accretions to surplus, the total should approximate $3 billion, or more than twice the balance at the end of 1951.

Market Outlook for Electric Utility Common Stocks

THERON W. LOCKE, Public Utility Research Specialist, Goodbody & Co, New York, N. Y.

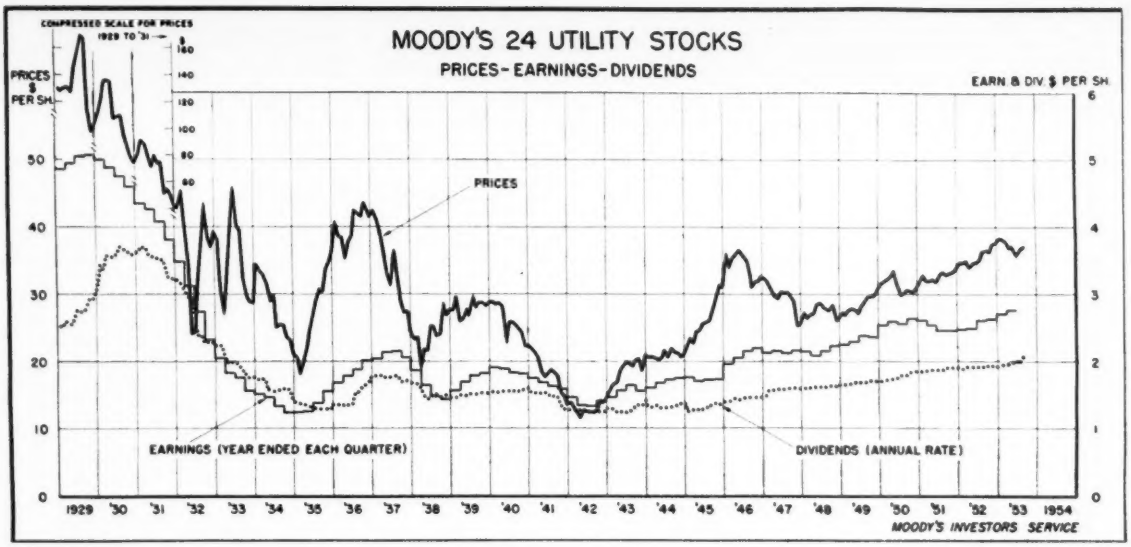
Common stocks of electric utilities should do better than the general stock market in coming months. They have strong investor acceptance. This is especially true of those which have been able to maintain a strong financial condition and also show an increase in per share earnings.

In a further general market decline these stocks might drop along with the industrial and railroad stocks. But as the latter kept dropping, there would be a tendency for electric utility stocks to level off when their yields got high. Their strong investor acceptance would come to their assistance. Managers of various types of investments funds would start to buy those electric utility stocks with the most attracive yields, quality considered.

Decline May Go Further . . . Some believe the stock market decline may go considerably further over the next few months. Those who are bearish cite the many problems faced by this country abroad, plus our own budgetary and debt refinancing problems, changes in taxes, foreign trade, etc. They believe we are going to have a considerable decline in general business over the next year, with a consequent substantial drop in most stock prices.

It is true that with the Korea fighting over the country is in a transition period. There will be pressure to cut armament expenditures and foreign aid. If business slows down, some electric companies may be able to extend their construction programs and consequently do less financing.

Even if the market were to decline, acceptance of a price moderately below the current market in any new stock offering of public utility would not necessarily do too much harm. For a utility cannot always expect to finance at a market level close to a 20-year high. If common stock financing costs more, regulation will need to be just that much more liberal.


MOODY'S 24 UTILITY STOCKS
PRICES - EARNINGS - DIVIDENDS
COMPRESSED SCALE FOR PRICES 1929 TO '31
PRICES $ PER SH.
EARN & DIV $ PER SH.
PRICES
EARNINGS (YEAR ENDED EACH QUARTER)
DIVIDENDS (ANNUAL RATE)
1929 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51 '52 '53 1954
MOODY'S INVESTORS SERVICE

A Favorable Outlook for Utilities . . . We feel rather uncertain about the near term business outlook but not about the favorable long term outlook for the electric industry. Prices of utility common will tend to fluctuate with business conditions, but the strong growth of the industry should continue.

For years financial analysts have been recommending electric utility common stocks for earnings and dividend stability plus longer term growth. Institutions, now the largest buyers, have bought on this basis. It is institutions such as the investment trust, pension fund, insurance company, bank trust department, savings banks, university and college portfolios, etc., that are the repository today for a large portion of the electric utility stocks distributed by holding companies.

Some Market Factors . . . There are numerous factors that will affect the market for electric utility common stocks. Among these are: business conditions, changes in federal taxes, possible partial tax exemption of dividends on preferred and/or common stocks, market effect of the probably large volume of new common stock issues, changes in money rates, potential saturation of investment portfolios. These are discussed below.

Business Conditions . . . General business conditions will affect the stock market. While electric utility common stocks should act better than the general market, they may decline sharply in any major break. But they should stop declining when their yields get high. While the institutional buyer may be selective and may tend to confine his purchases to stocks of companies with well diversified revenues, good dividend coverage, and not too heavy dependence on industrial load, most electric utility common stocks would be benefited from this type of purchaser.

Recession Resistance . . . If we should slip into a severe recession, the question of recession resistance would loom large in the minds of institutional buyers who purchase for income and longer term growth. Historically the electric industry has an excellent record of revenue stability in periods of adverse business conditions.

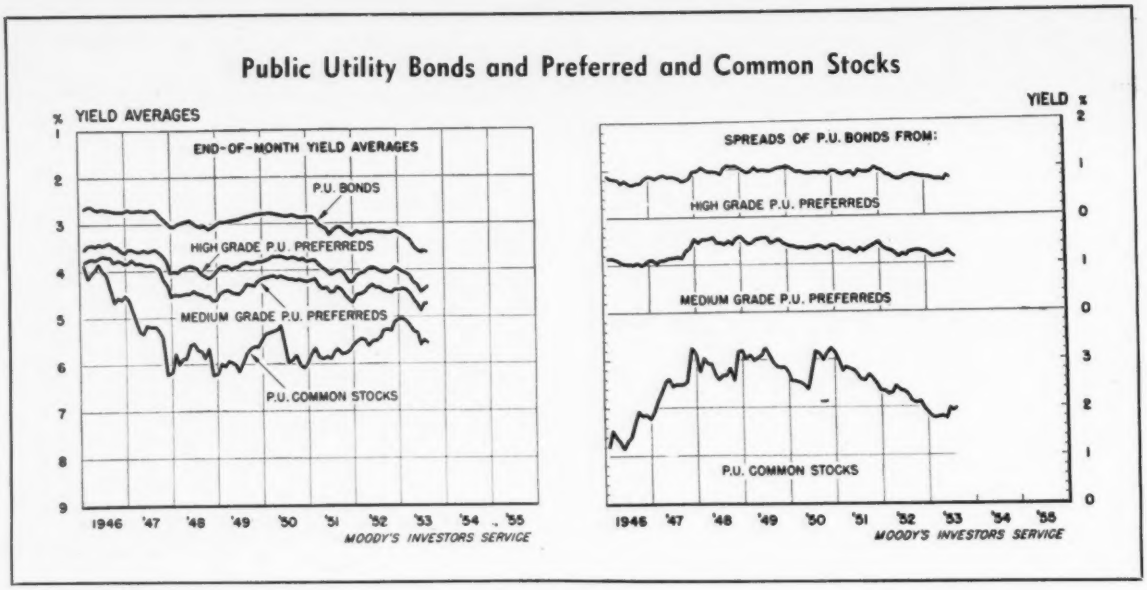
Some analysts point to the less satisfactory record in theh '30's as far as net income in concerned. The writer does not believe that the electric industry would be nearly so badly affected even in a severe recession as it was in th 1929-33 depression or the sharp but very severe recession in 1938. This is true even of some electric companies which derive a much above average percentage of revenues from the less stable industrial classification (large light and power).

However, our studies indicate that much would depend on the length and severity of a depression. Because of special types of contracts with large industrial users, many electric companies with an unduly high percentage of revenues from large light and power sales would be well protected during the first year of a business decline.

There are some that have contracts with minimum amounts high enough to give the utility a good degree of protection throughout a depression, regardless of length. Companies with above average revenues from industrial sales realize their position, and most of them have taken steps to protect themselves.

Also, except in a very few cases, most companies with heavy industrial loads serve a diversified area not dependent on a concentration of one industry. They might have a decrease in industrial sales, and also some loss of commercial sales, but their over-all revenues would probably hold up fairly well because of their diversified territory.

Regardless of the duration of a business set-back the effect would be much less severe now than in the 30's because tax rates are so much higher. Another favorable factor is a much greater degree of investor acceptance of the electric industry today than at any previous time. With their improved financial condition (intangibles and write-ups provided for or eliminated), average common equity usually 30% or higher, and conservative capital structures, this group can hardly be compared with the electric companies of the 30's in any respect.


Public Utility Bonds and Preferred and Common Stocks
% YIELD AVERAGES
END-OF-MONTH YIELD AVERAGES
P.U. BONDS
HIGH GRADE P.U. PREFERREDS
MEDIUM GRADE P.U. PREFERREDS
P.U. COMMON STOCKS
1946 '47 '48 '49 '50 '51 '52 '53 '54 '55
MOODY'S INVESTORS SERVICE
YIELD %
SPREADS OF P.U. BONDS FROM:
HIGH GRADE P.U. PREFERREDS
MEDIUM GRADE P.U. PREFERREDS
P.U. COMMON STOCKS
1946 '47 '48 '49 '50 '51 '52 '53 '54 '55
MOODY'S INVESTORS SERVICE

Federal Tax Changes . . . Press reports indicate that the federal tax structure is being studied with a view to major changes. Some of these are already scheduled, such as the drop from 52 to 47% in the corporate tax rate and the elimination of the excess profits tax.

It is generally agreed that Congress may do something to make up for these losses. But what form the new taxes will have is not at all certain. Chances are that the Administration will try to keep the 52% rate. But some compromise may end up in a drop to 50 or 47% with some form of a sales tax.

The electric industry will be vitally affected by any change, for with revenues limited by regulation, and only 10% to 12% of operating revenues carried through to the common stock, taxes are one of the most important items. We have estimated that a drop in federal taxes from 52 to 47% could result in a 10 to 11% increase in net income for numerous electric companies.

There is, however, a danger in new forms of taxes. For example, if a manufacturers' sales tax were imposed, would the utilities be able to add it to a consumer's bill? Or would the utility have to pay this tax and try to get offsetting rate relief? We do not find any assurance that such a tax could be automatically passed on by a utility.

There is also talk about making a portion of dividends tax exempt. This could help utility stocks very materially. It could be a very important market factor. For by adding some tax exemption to the favorable features of long-term growth plus earnings and dividend stability, this group of stocks could become the No. 1 choice of individuals seeking income.

Large Scale Common Financing . . . If the scheduled construction program of business-managed electric companies of around $3 billion each year through 1956 is not reduced, these companies are going to have to do a great deal of financing. An important part of it will have to be in equities or securities convertible into common stock.

This means that we can look for a continuing supply of new issues of electric utility common stocks for the next three or four years. It is quite possible that these offerings may at times be too large or numerous for the market to absorb. This seems to happen every so often because when the market appears favorable a number of companies sometimes decide simultaneously to sell additional common.

Of course the offerings are known to be pending when they have been registered with the Securities and Exchange Commission (or are listed in the Financing Table of Electrical World). The companies and the underwriters do their best to space offerings so as not to compete with another offering on the same or perhaps the next day. This is one problem that cannot be readily solved. It is a market factor even though only a temporary one. For by offering too much stock in a short time, companies tend to get a lower price than otherwise. Thus they have to get more money in some other way to provide the total amount needed.

Investment Portfolio Saturation . . . Is there going to be a large enough market to absorb the large volume of equity financing the electric utilities face if they carry forward the present schedules of construction through 1956? We think the market will be large enough if the earnings trend continues favorable and if the general stock market does not have too severe a decline.

The market for electric utility common stocks and for some other types of common stocks has been broadened very considerably by liberalization of laws governing the investment of funds by trust departments, insurance companies, and savings banks. There has been a great growth in the number of investment trusts, particularly of the "open-end" type known as mutual funds. Also there has been a great growth of pension funds.

All of these institutional investors can now buy electric utility common stocks. We know of a number of them that have been buying a considerable amount of these common stocks. Furthermore individual savings are the largest in history. Mutual savings banks in the United States have over $23 billion on deposit. So there still

exists a good reservoir of buying power in this country.

We have heard that the total asset value of pension funds today probably exceeds $6 billion. It could be much larger. We do not have accurate figures. But we do have figures as to the value of investment companies (including mutual funds) registered with the SEC. As of June 30, 1952 there were 367 investment companies registered with the SEC under the Investment Company Act. They had total assets of $6.8 billion. This compares with 358 companies with $3.7 billion in total assets on June 30, 1949.

There has also been a large increase in the number of pension funds. They, like the mutual funds, have been growing rapidly both in number and size. In addition the greatly increased market for common stocks provided by the liberalization of laws governing the investment of trust funds, savings banks, etc, has substantially broadened the market for equity securities.

This broadening has been responsible in no small part for the absorption of the large amount of electric utility common stocks distributed in the market in the past five years. It is also of interest that life insurance companies are reported to own now two thirds of the funded debt of the country's public utilities.

Money Rates . . . The factor of money rates is probably one of the most important of all in the outlook for the electric utility common stock market. The sharp severe decline in the market prices last May when the government bond market declined sharply brought clearly into focus the close relationship between the market valuation of electric utility common stocks and money rates.

Prior to the break last spring the utility market had been doing exceptionally well. From the lows at the time of the Korean invasion late in June 1950 to the highs reached early in 1953, Moody's Investors Service utility average of 24 electric utility stocks rose 29%. In the market decline last May the Moody's utility average dropped 9%; whereas its industrial average declined 10%.

The severity of the drop in electric utility stocks seemed to come as a considerable surprise to many investors. This is understandable because this break was due to a change in money rates. They have not been much of a factor because of such easy money conditions for so long. It is interesting that the utility averages snapped back vigorously when the market for U. S. Treasury bonds stabilized and rallied.

The chances are that the market action of the utilities last spring has put the institutional investor on guard. He will probably be much more alert from now on to the possible effect of changes in money rates on the market valuation of utility common.

For it is quite evident that electric utility common must sell on a yield basis relative to the yields on high grade bonds and good grade preferred stocks, with an appropriate spread between each. Hence from now on any important changes in money rates are likely to be correspondingly reflected in the market prices for electric company common stocks.

Charts on Yields Included . . . Three charts based on data compiled by Moody's Investors Service are included in this article. One shows the average yields on public utility bonds, on utility preferred stocks, and on 24 electric utility common stocks. The second shows the spread in yield between the bonds, preferred stocks, and common stocks. The third shows market prices, earnings, and dividends on 24 electric utility operating company stocks since 1942 and a combination of holding and operating company stocks from 1929 through 1941. The charts showing comparative yields and the spreads in yield between bonds, preferred stocks, and common stocks show them only since 1946.

The charts on yield and yield spreads are of significance in showing that there is a direct money rate relationship (in yield) between utility bonds and utility preferred stocks and common stocks. In 1946 the spread between the yield on the bonds and on the 24 common stocks narrowed to only 1.2 points. The highest spread during the year was 1.84 points of yield, the lowest 1.2 points, and the average 1.52 points.

Looking backward, this narrow spread indicated that the stocks were a sale; and they were, for the market broke sharply in 1946 and by 1947 the spread reached 3.21 points. At this spread the stocks were more attractive than the bonds. In 1948 the spread range was 3.17 high, 2.61 low; in 1949 it was 3.19 and 2.71; in 1950, 3.23 and 2.41; and in 1951, 2.76 and 2.66. In 1952 it again narrowed reaching a low spread of 1.88 compared with a high for 1952 of 2.39. And thus far in 1953 the spread has been as high as 2.08, as low as 1.81, and is now about 1.97 points.

Our own conclusion from these charts is that when the spread in yield is less than 2 points, electric utility stocks are not so attractive for relative yield purposes as bonds. When the spread exceeds 3 points stocks are considerably more attractive than bonds for yield purposes. It would also appear that at present the yield on utility stocks is on the low side in relation to the yield on bonds. Hence utility bonds are moderately more attractive than the 24 electric utility stocks on a relative yield basis.

Spread charts like these should be useful in planning financing. They also prove the adage that utility stocks are attractive with yield over 6%, unattractive under 5%.

Economic Outlook . . . In this issue are tabulations showing the projected forecast of a number of the more important business and economic indexes. Of particular interest is the forecast of an increase in residential customers from 41.4 million in 1953 to 52.4 million in 1963, up 11 million. The increase in expected sales is tremendous from 97 billion kwhr this year to 226 billion in 1963. Residential users are thus expected to be using 2.33 times as much energy 10 years from now as at present.

Sales to commercial users would increase from 68 billion to 150 billion kwhr, over 2.2 times. And sales to industrial users including the Atomic Energy Commission would rise from 189 billion to 349 billion kwhr.

Total sales would increase from 381 billion kwhr scheduled for 1953 to 763 billion ten years hence.

It is interesting that these forecasts show an upward trend in every classification each year from 1953 through 1963 despite the fact that the forecast figures on the economic outlook show a decline in 1954 and also in 1955 in the basic indexes. The declines in those years are not particularly large, but they appear to indicate that some reduction in business activity is expected during the next two years.

Our checks indicate that most business men and economists believe that the huge defense spending program of

the government is likely to be continued at a relatively high level for several years. Therefore, the reasoning is that we cannot have a serious business setback so long as this prop is there. The writer believes that while we have it, we need to find a way to be prosperous with less of a prop.

Are Electric Utility Common Stocks Cheap? . . . From the historical market standpoint the electric utility common stock averages are close to a high for the past 20 years! But these stocks are not unduly high on current earnings and dividends. The historical record is clearly shown in the charts included herein.

From the great heights of $169.80 reached in 1929 the Moody's utility average shown on the chart on page 151 dropped to a low of $11.41 in 1942. It moved up gradually but steadily to $36.62 in 1946, then dropped sharply to $29 in the 1946 break. It then moved up to $33.50 early in 1950. The Korean invasion caused a sharp drop again to $29.73 in July 1950 after which the averages started another strong upward move, reaching a high of $33.85 in 1951, and a further gain to $37.85 in 1952.

They kept rising early in 1953, reaching a new 20-year peak of $38.72 last spring. The money market scare in May and June 1953 caused a drop to $34.95, and the averages are now about $37.33 but still are only $1.50 below their 20-year high.

But the averages do not tell the whole story. Some electric utility companies have doubled their per share earnings in the past ten years while others are earning little more per share now than ten years ago. In the next ten years this may happen again because of differences in rate of growth and in the financial policies of the managements.

Growth must be accompanied by the type of financial policy that takes advantage of growth and transforms it into higher earnings related to the shares outstanding. There are two schools of thought as to the wisdom of paying out a high percentage of earnings in dividends, issuing valuable stock dividends and rights, and keeping the stockholders happy in that fashion.

One favors this policy. Another school favors keeping and reinvesting 25% or 35% of earnings available for the common stock each year, issuing rights of only nominal value (if rights must be used) and no stock dividends, and seeing to it that every share issued is sold at the then full market value. A company cannot increase earnings per share sharply and still hand out valuable rights and stock dividends at the same rate.

The question is whether a management wants merely to maintain the present level of per share earnings, and pay out all it earns each year in cash plus stock, and issue valuable rights when the company needs common stock money—or whether it wants to reinvest part of each year's earnings and thus perhaps double per share earnings when it doubles the size of the company through growth. This is the crux of the problem.

The outlook for the utility market will be affected by the policy most companies choose. It is to be hoped that only a small portion of the electric utility companies decide to be unduly generous to stockholders at the expense of future growth of earnings per share. For if investors find that their electric utility companies are not showing increasing per share earnings consistent with the huge amounts of new capital invested to double the size of a company in ten years (or less), they may not be nearly so interested in electric utility stocks as they are now.

They may sell the stocks of such companies and buy into others more to their liking. The future of the market for electric utility stocks seems to the writer to depend on the ability of the industry to so handle its financial policy as to show increased earnings per share as the size of the industry increases. Growth in plant and operating revenues must also be reflected in growth per share of common stock. If regulation is fair and cooperative, this can be accomplished.

One thing seems certain. The growth of this great industry is likely to continue at a fairly high rate for some years. Growth can overcome practically everything but government competition. Growth can smooth out the temporary effects of business declines. It can ease the pressure of high costs. It gives new life to the industry every day, every month, every year. It is the secret of the great financial success of this industry.

Summarization . . . The market outlook for the electric utility common stocks is favorable on a relative basis. In a market break these will decline along with all other stocks. But because of their strong investor acceptance, particularly by informed professional buyers, they should not go down nearly so far in market price as many industrial or railroad common stocks. The yields on electric utility common stocks should tend to create buying by institutional buyers. They are probably the best group of stocks an investor could own, from the standpoint of relative market stability, plus historical demonstrated earnings and dividend stability.

The growth of the industry should be of great help in maintaining and improving earning power. And the sound financial condition should enable the electric industry to weather even a severe economic storm. This assumes, of course, that the industry is able to continue to obtain reasonably cooperative and fair treatment from the regulatory authorities and that political conditions do not develop so adversely as to create uncertainty as to the maintenance of the industry's growth and maintenance of adequate earning power.

Regulation is probably the most important single factor in the outlook for earnings. Political atmosphere is a close second. Money rates will also be an important market factor, as will the trend of general business and the pressure of the expected flow of many new issues of common stock to help pay for the large amount of new equipment scheduled to be added in the next few years.

Based on what has happened in the past, we feel confident that the industry can take these problems in its stride. There will be times when things will look less favorable. Sometimes they may even look black. But the demonstrated ability of the managements of the industry to meet and overcome difficulties, and the great growth factor of the industry, should enable it to come out on top.

Tax rates may become somewhat less of a burden. Dividends may be made partial exempt. The use of electricity is bound to continue to grow. We have just scratched the surface of the many uses of electricity. The electric industry has had a thorough financial house cleaning. It is in wonderful financial shape, excellent physical condition, and there is a wonderful spirit of service and accomplishment that permeates the entire industry. In all the long term outlook looks good.

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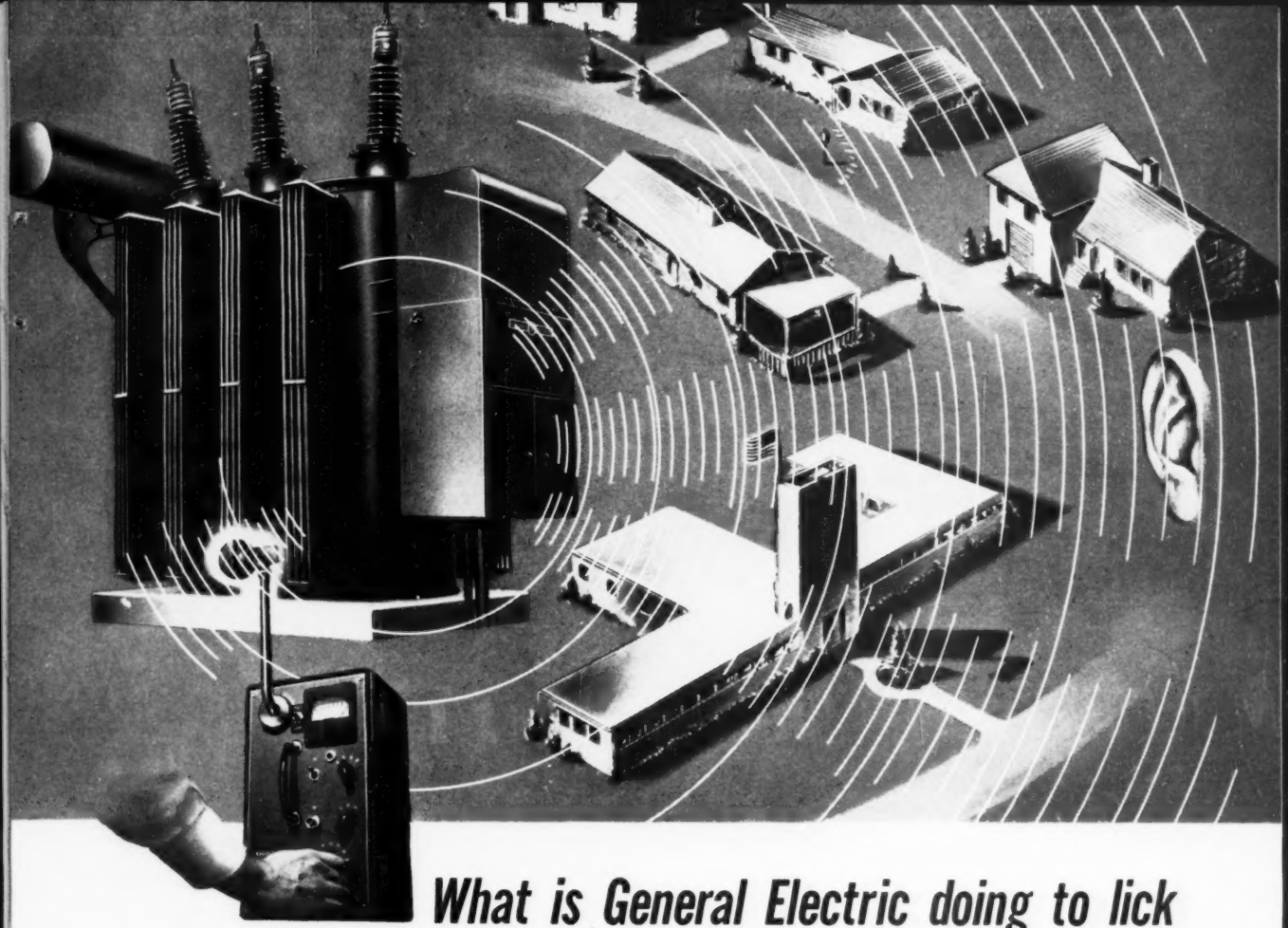


What is General Electric doing to lick

THE TRANSFORMER NOISE PROBLEM?

Are lower noise levels possible without increasing size, weight or installed costs?

Increasing the capacity of existing stations and transforming power closer to the ultimate customer are realities of today's power system design.

Sensitivity to transformer noise has increased because of these trends which frequently dictate the installation of large power transformers in thickly populated areas. Also to hold the size and weight of large units to a minimum for ease of shipment and installation, the transformer designer is using materials more effectively. This, too, has aggravated the noise problem.

General Electric engineers, as one of the first steps in their research of transformer sound emission, analyzed the complicated acoustic circuit of a power transformer. This analysis pointed up 2 major sources of noise:

1. *The core,* through magnetostriction in the core steel and in some ratings, vibrations in the joint regions.
2. *Accessories,* such as fans, coolers, and pumps.

Vibrational energy from these principal sources follows many paths through the transformer, driving various parts of the structure. Mechanical resonance further adds to the problem. At external surfaces, this vibrational energy is transformed into audible waves of acoustic energy and emitted to the air.

Field and laboratory studies have shown that to reduce the amount of acoustic energy emitted to the air involves:

1. Reducing the energy at the source.
2. Use of resilient mounts between core and tank base to minimize energy reaching the base which, in turn, drives the tank walls.
3. Use of barriers between core-and-coil structure and tank wall, to reduce energy transmission through the oil to the tank wall.
4. Use of flexible couplings and mounts for auxiliaries external to the tank.

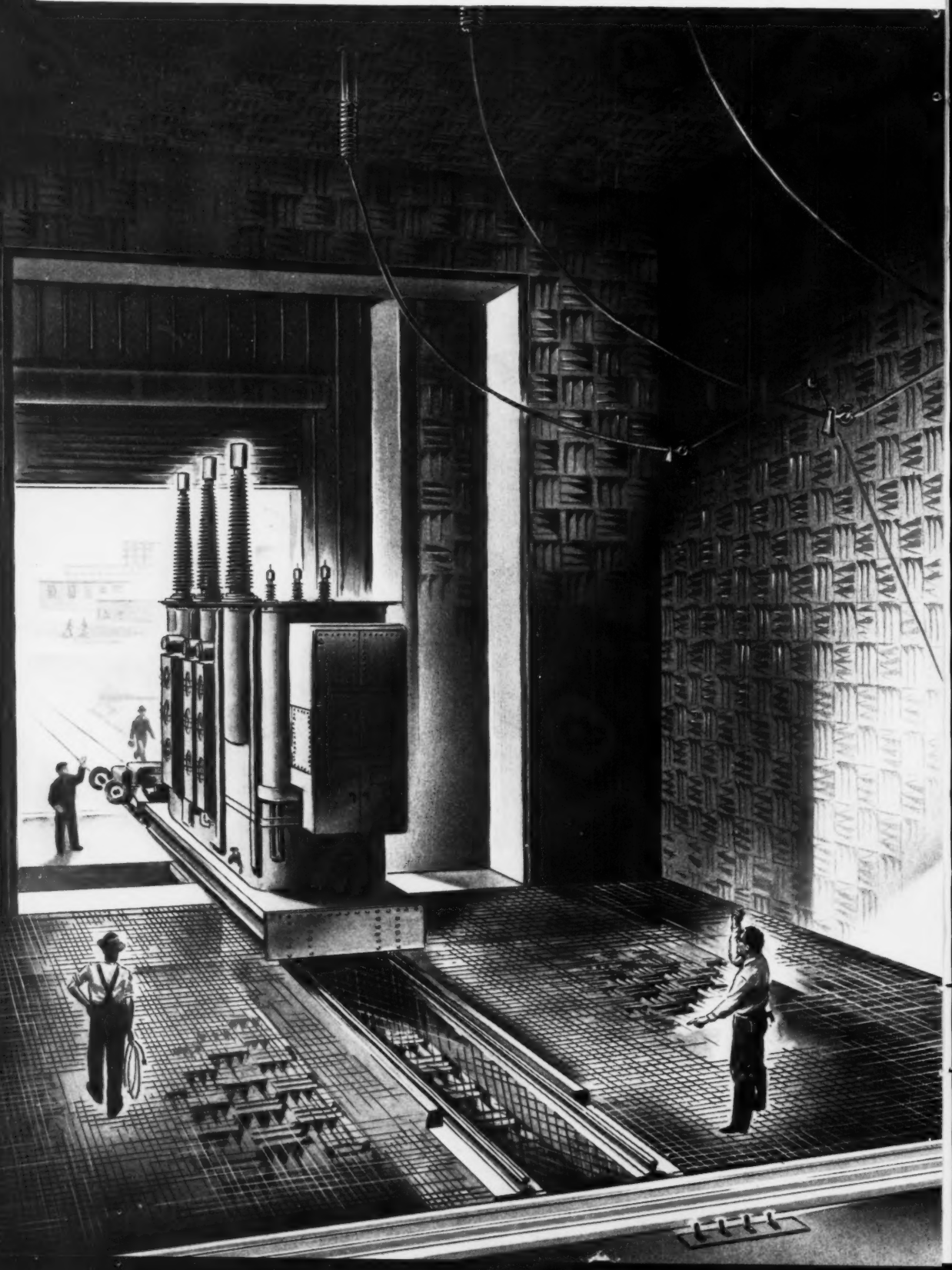
To reduce aggravation of the noise problem by resonance requires: (1) determination of resonant modes of vibration of the core, tank and accessories; (2) development of techniques and instruments for measuring these resonant effects; (3) development of means for modifying resonant effects.

To evaluate our progress and to permit new and more accurate investigations, we are now building a new laboratory designed for making complete noise tests on the largest transformers presently contemplated.

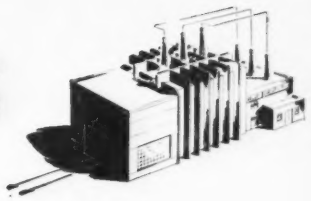
For further details, see next page. ➧

GENERAL ELECTRIC

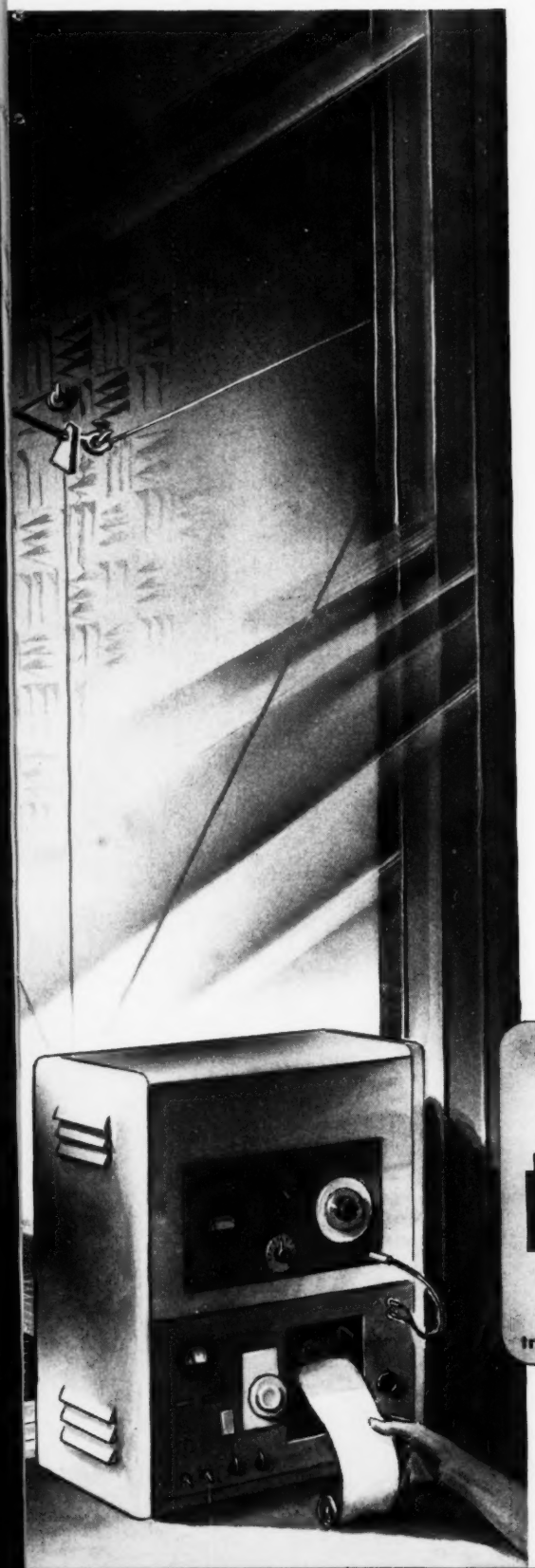
New G-E anechoic sound laboratory.



. for quieter power transformers



at lower cost

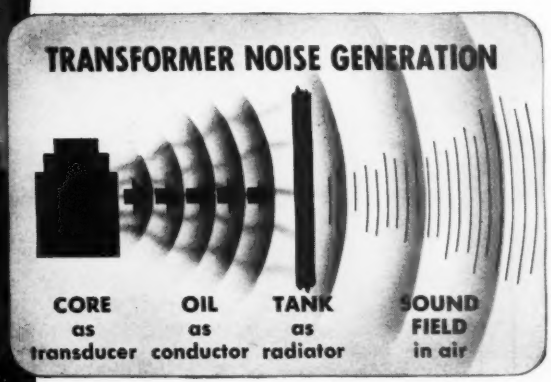


Accurate diagnosis of the causes of transformer noise is half the cure. Believing in this theory, General Electric is now building a new $1,500,000 anechoic sound laboratory at Pittsfield, Mass. This new lab, believed to be the largest in the world devoted exclusively to the study of sound, will be in operation by June, 1954. It will include advanced design measuring equipment that will make possible more complete studies of noise transmission and emission than have ever been possible before for large electric apparatus.

The new laboratory will pay its own way. Like G.E.'s High-voltage Laboratory which has helped so greatly toward solving lightning problems, it will be a cost reduction tool that must ultimately lead to quieter power transformers at lower cost.

A few of the features of this new lab are shown by the illustration at the left. Looking from the control room into the anechoic chamber through three thicknesses of glass, you can see the strange pattern formed by the Fiberglas wedges which eliminate echoes. A low ambient noise level and high absorption coefficient (.995) are obtained by double walls acoustically treated. Coming through the air-pressure-sealed doors (each 16 feet by 41 feet, motor-operated) is a 300,000-kva power transformer (the chamber will handle units up to 500,000 kva) on a specially built 28-foot transfer car. The small sketch at the top of page shows the exterior of the new building. The left section is the entry room, the large center section with the external stiffeners of reinforced concrete is the anechoic chamber and the right section contains the control and power supply rooms. The power is brought into the anechoic chamber through three high-voltage bushings in the roof.

The far greater test accuracy possible with the facilities contained in this new laboratory will permit General Electric to pin-point noise factors in power transformers to an extent never before possible. It is expected that new techniques, sure to result, will do much to lower noise levels without increasing costs to the user. General Electric Co., Schenectady 5, N. Y. 421-9

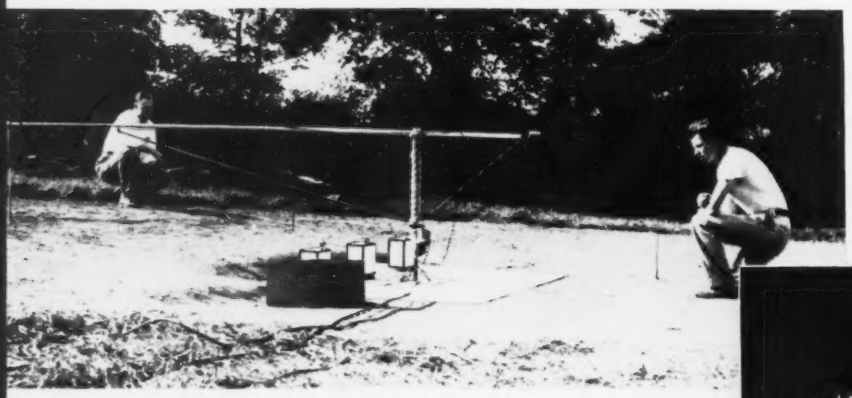


SIMPLIFIED SCHEMATIC of transformer noise generation shows how noise is transmitted to the outside air.

Progress in Power Transformers

GENERAL ELECTRIC

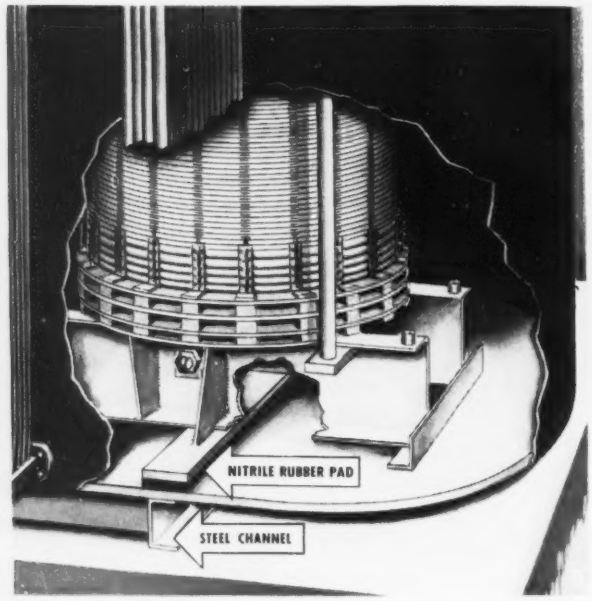
Scale models—low-noise-level building—new mounting arrangements; all further progress toward reduction of power transformer noise



FIELD STUDIES have been made on scale models of actual transformer installations as shown here. These models give accurate information on noise pattern being emitted, suggesting nature and configuration of practical external sound barriers.

LOW-NOISE-LEVEL BUILDING is now used to test complete transformers as large as 5000 kva and to permit developmental studies.

DYNAMICALLY DESIGNED BASE with in-line mounts is a recent contribution to control of noise. A resilient pad is located between lowest core member and tank bottom. A specially designed steel channel is placed under the tank bottom, in direct line with this pad, to provide the stiffness needed for vibration isolation.



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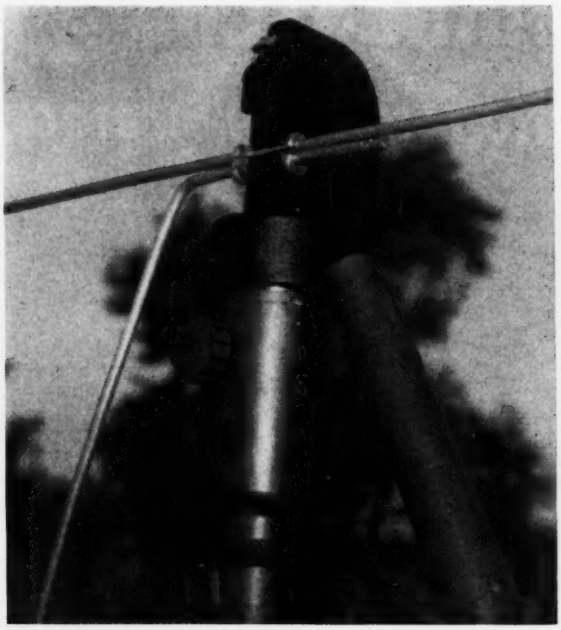
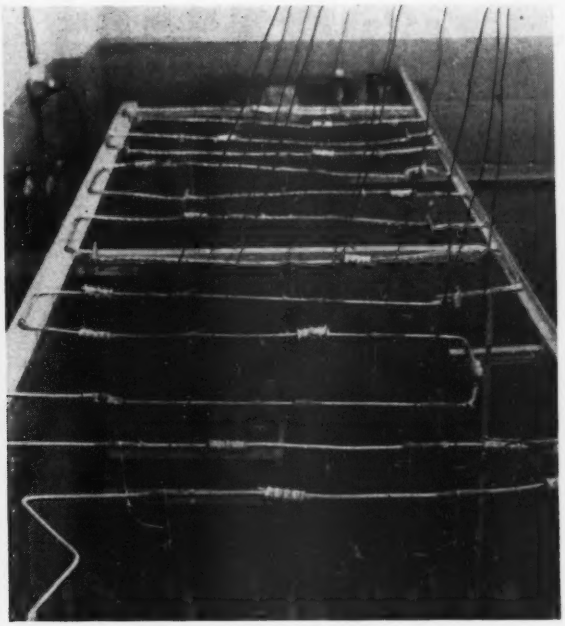


HAND-OPERATED tool applies "C" connector to tap aluminum lead on an aluminum run. Hands grip tool at point just below picture



TEST TRACK for heat cycles had 16 compression connectors joining sections of No. 2 solid and No. 2 stranded aluminum conductor

Compression Solves Distribution Connections

I. MATTHYSSE, Chief Design Engineer
H. P. DUPRE, Development Engineer
Burndy Engineering Co, Inc, Norwalk, Conn.

Exhaustive tests of a new C-shaped compression connector prove that a simple way has been found to make properly designed compression joints without cutting conductors. These connectors supplement more conventional compression splices to provide reliable joints for all applications on aluminum or copper distribution lines.

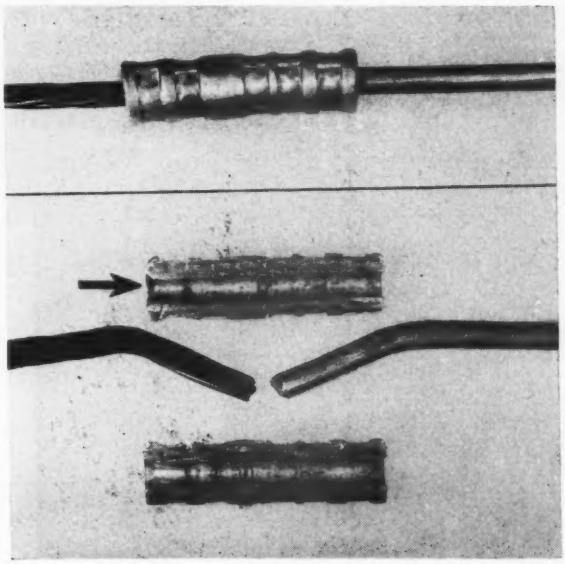
The recently developed "C" connector has been shown capable of maintaining adequate contact pressure. This ensures low contact resistance and anchors conductors against twisting, vibration, and other stresses. The open side makes it possible to slip the connector over a continuous run conductor.

Extensive tests indicate that the best structural shape for the new device, which uses aluminum or copper of controlled ductility and hardness, is with a relatively heavy wall thickness at the back of the C, tapering off toward the edges. Aluminum connectors are used for aluminum conductors, copper for copper. Here's how this design performed when prepared with scratch brushing and a good connector compound:

Tests Results . . . A tensile test subjected connectors to forces in excess of the stress that might develop on a service or equipment tap. A pullout force of 1,960 lb was obtained on a connector that joined 4/0 stranded to No. 2 solid copper conductors. Similar tests on No. 4 stranded aluminum developed 700 lb.

A spray test proved their resistance to corrosive atmos-

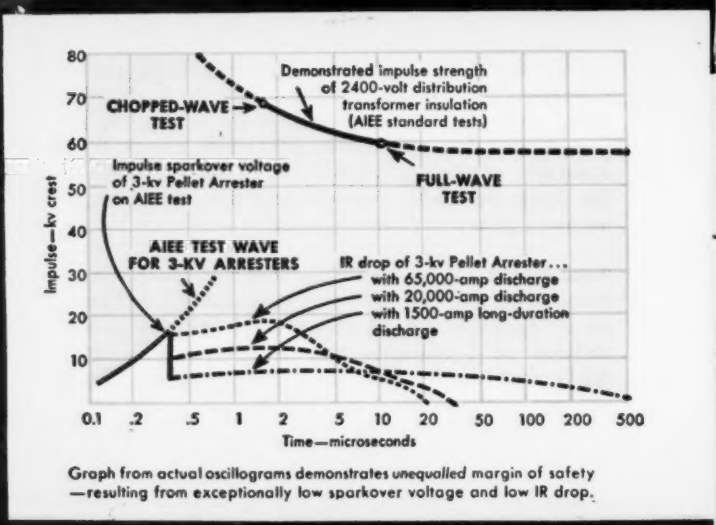
(*Continued on page* 162)



ARROW MARKS SLIGHT CORROSION of an Al-Cu compression joint after accelerated test. Neither conductor nor the interior surface of sleeve shows any attack. Sample above shows original appearance

PELLET ARRESTERS

no other distribution arrester protects



Graph from actual oscillograms demonstrates *unequalled* margin of safety —resulting from exceptionally low sparkover voltage and low IR drop.

so well . . . . because no other arrester

- **has such low impulse sparkover and low IR drop**
- **retains its protective characteristics for so long**
- **is so completely self-protecting against moisture**
- **is so universally applicable on all systems**

General Electric pellet lightning arresters assure the most complete and durable system protection available . . . enabling a new high in continuity of electrical service—at a new low in operating costs and maintenance of distribution systems. Whether lightning currents are high or low, with durations long or short, no other distribution arrester holds voltages to such low levels. And because it's a valve-type, the pellet arrester can be applied universally—on urban, rural or industrial distribution systems—no worry about available or future short-circuit currents, expulsion arc-flames, or high follow currents blowing fuses and depleting the arrester's life.

Remember also, pellet arresters are backed by *35,000,000 arrester-years of proved operation*—a service record unapproached by any other arrester. For complete information on G-E pellet arresters, available in ratings 1 kv through 15 kv, contact any G-E apparatus sales office, agent or distributor, or write for Bulletin GEA-2975. Address Section 432-4, General Electric Company, Schenectady 5, New York.

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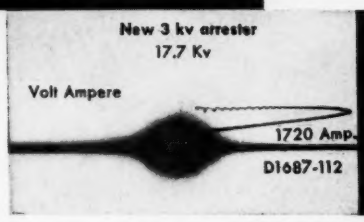
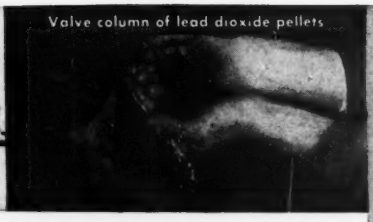
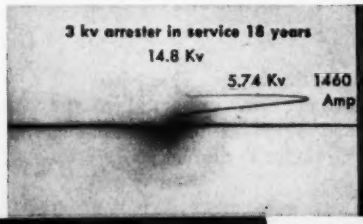
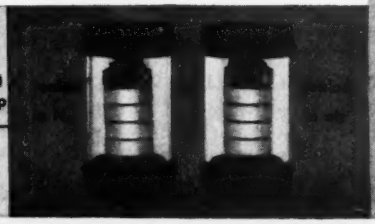


Oscillograms of performance of new and old arresters prove that the excellent protection by pellet arresters stays excellent.

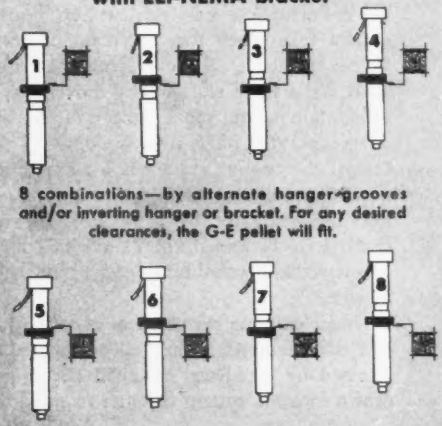


Pellets unaffected by service moisture. Nitrogen-filled gaps exclude corrosive moisture—proved by life tests (below).

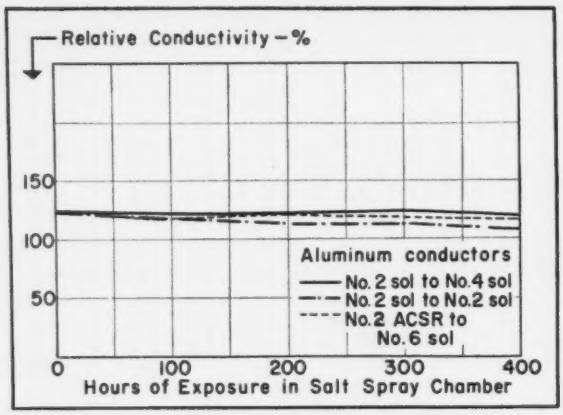




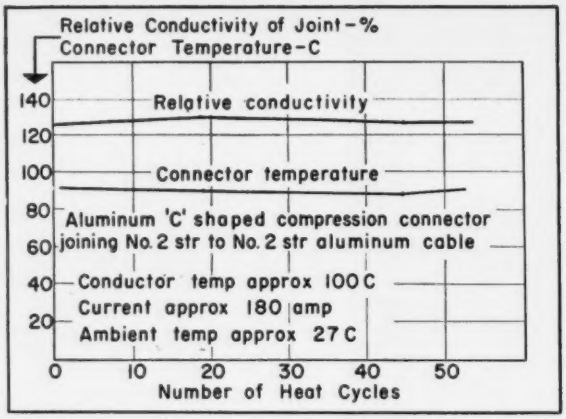
Crossarm mounting combinations with EEI-NEMA bracket



8 combinations—by alternate hanger-grooves and/or inverting hanger or bracket. For any desired clearances, the G-E pellet will fit.



SALT SPRAY corrosion test of "C" connector showed conductivity virtually unaffected by severely corrosive atmosphere



HEAT CYCLE test showed stability of connection during load cycles of 1½ hours on and 1 hour off. Connector was cooler than conductor

phere. They were required to perform in the severely accelerated atmosphere of a salt spray chamber containing a fog of 20% solution of sodium chloride at 98 F. The relative conductivity of joints remained virtually constant and above 100% for 400 hours of exposure.

Heat cycle tests collected evidence that the connector temperature and the relative joint conductivity remained almost constant even when load cycled to a conductor temperature of 100 C. This temperature was deliberately chosen because it is well in excess of those anticipated in overhead distribution work. The connector remained cooler than the 100 C conductor temperature throughout 54 load cycles of 1½ hours on and 1 hour off.

Al-Cu Joints . . . Joints between copper and aluminum call for a different treatment, involving a new engineering approach. Electrolytic action between aluminum and copper does not attack copper, which is cathodic, but only aluminum. In the new method, the aluminum conductor is gripped in one end of aluminum compression connector; the other end of this connector is pressed on the copper conductor. The only bi-metallic juncture is between a large aluminum mass and the smaller copper conductor, leaving the aluminum conductor protected against corrosion.

Tests of such joints between No. 4 stranded copper and No. 2 solid aluminum produced virtually no corrosion. Very slight pitting appeared on the end of the aluminum connector adjacent to the copper conductor. But there was no evidence of electrolytic attack on either conductor.

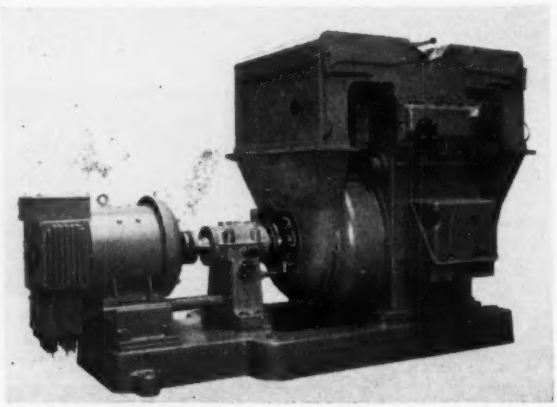
Modifications of this principle permit connecting aluminum risers to copper terminals on transformers and equipment. Also, forming the aluminum connector as an "L" with one leg tubular and the other "C" shaped makes copper taps on aluminum runs. This eliminates threading the conductor through tubular compression connectors.

Generator Cooled for 114F Ambient Temperatures

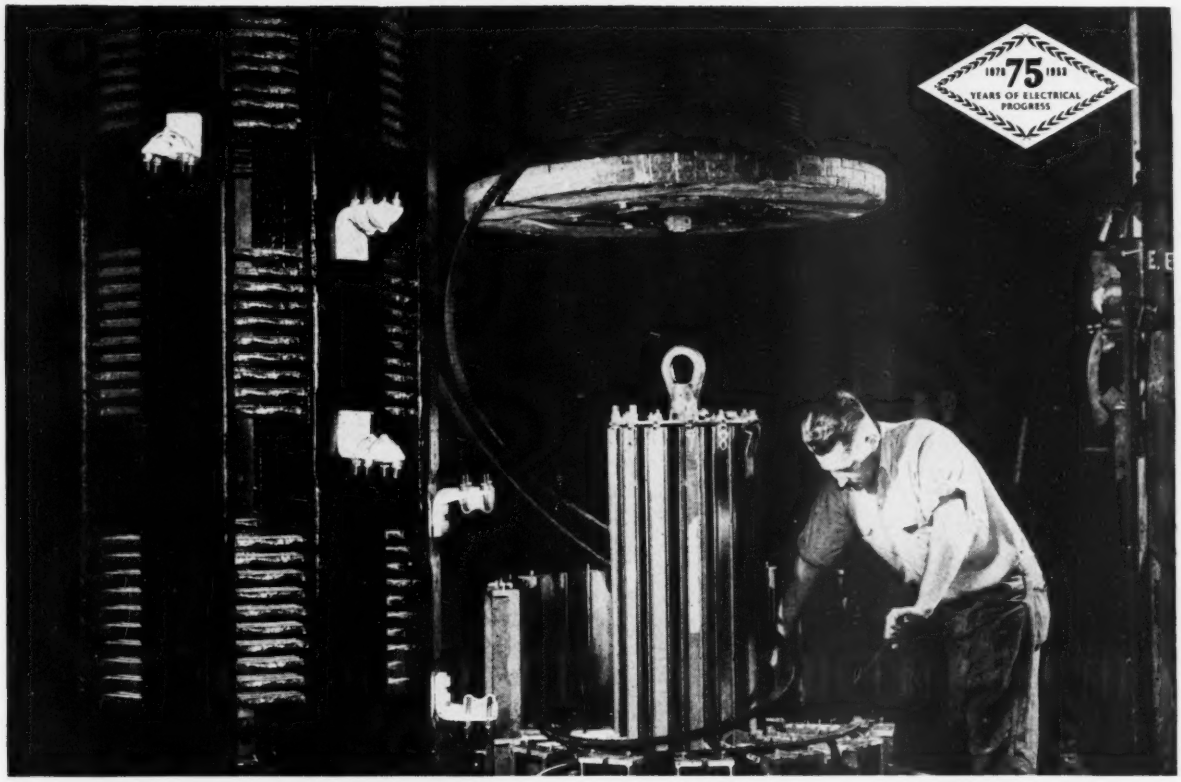
J. H. JUPE, Research Laboratories of General Electric Co, Wembley, England

Special cooling arrangements to ensure generator operating reliability under ambient temperatures up to 114 F have been developed by General Electric Co of England for a Portuguese East Africa sugar factory. The cooling system overcomes two other difficulties: It will operate in the presence of considerable bagasse dust and has been made flood resistant by moving the cooler from the foundation to the top of generator housing.

Incorporated on a 700-kw, 400-v, 3-phase, 60-cps generator, the cooling system is a closed-circuit type. Under normal conditions air is drawn through the water cooler into the generator by rotor fans and is exhausted into vertical ducts joined to the cooler's air inlet. Air then passes around water tubes and is recirculated through the machine.



Under extreme temperature conditions, when closed circuit is inadequate, spring-loaded dampers in air ducts are released by trip lever mounted above the cooler. Air is drawn into the system through two apertures in the ducts' top faces and passes through the cooler. From here air is drawn through the generator and exhausted to the atmosphere via vents in ducts' sides. Dampers are closed by hand when it is desired to return to normal.



Save 10% on new G-E reactors with aluminum conductors

Same long life, same low maintenance, same high short-circuit strength . . . at 10% less cost

Now you can save 10% by buying General Electric cast-in-concrete reactors with *aluminum conductors.* These new G-E aluminum reactors will give you the same dependable performance—the same high degree of protection—as G-E units built with copper . . . at 10% less cost. There has been no sacrifice in the reactor quality that has been the favorite of industry for more than 35 years.

The "extra service" features of G-E reactors—both aluminum and copper types—that provide practically unlimited life and make maintenance a minor factor, include:

Non-aging glass insulation which assures greater protection against turn-to-turn short circuits than any other type of wound insulation used in reactor manufacture . : . withstands extremely high temperatures . . . remains unaffected by moisture and will not deteriorate even under high overloads.

Continually transposed conductors assure more uniform current-distribution . . . reduce losses, and increase short-circuit strength.

Wet steam curing assures full strength of concrete at shipment—no dangerous waiting period which occurs if concrete must cure after reactor is placed in service.

Other features include: good clearances; crossovers made within concrete supports; smooth, flameproof black japan finish and silver-plated terminals.

Metal housings, with provisions for cable entrance and exit can also be provided that will match the appearance of G-E switchgear. These housings minimize stray currents and electrical losses, protect reactors against damage, and increase safety for personnel.

You can buy these sturdy, dependable G-E cast-in-concrete reactors with either aluminum or copper conductors. For full information contact your nearest G-E Sales Office or write General Electric Company, Section 422-5, Schenectady 5, N. Y.

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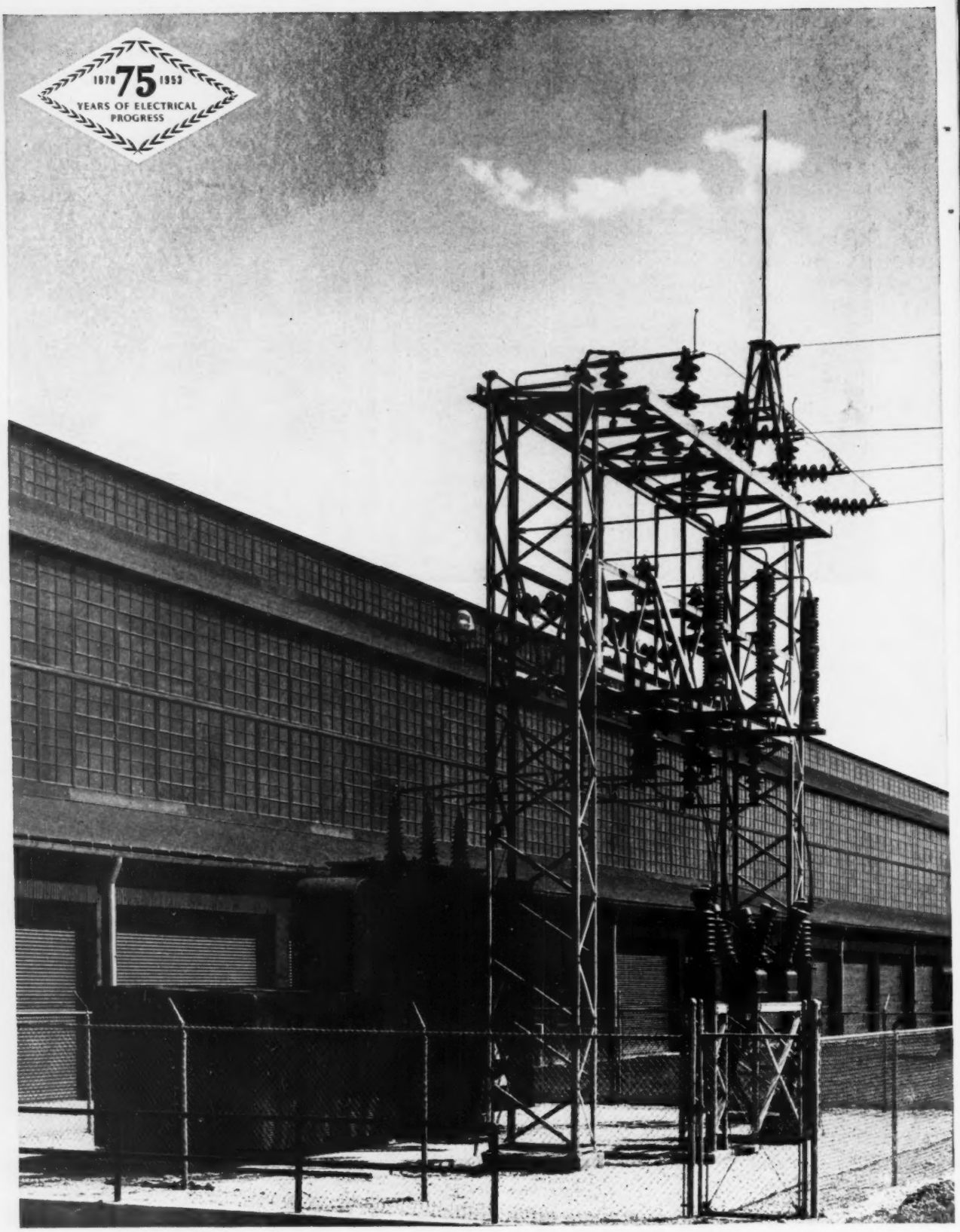
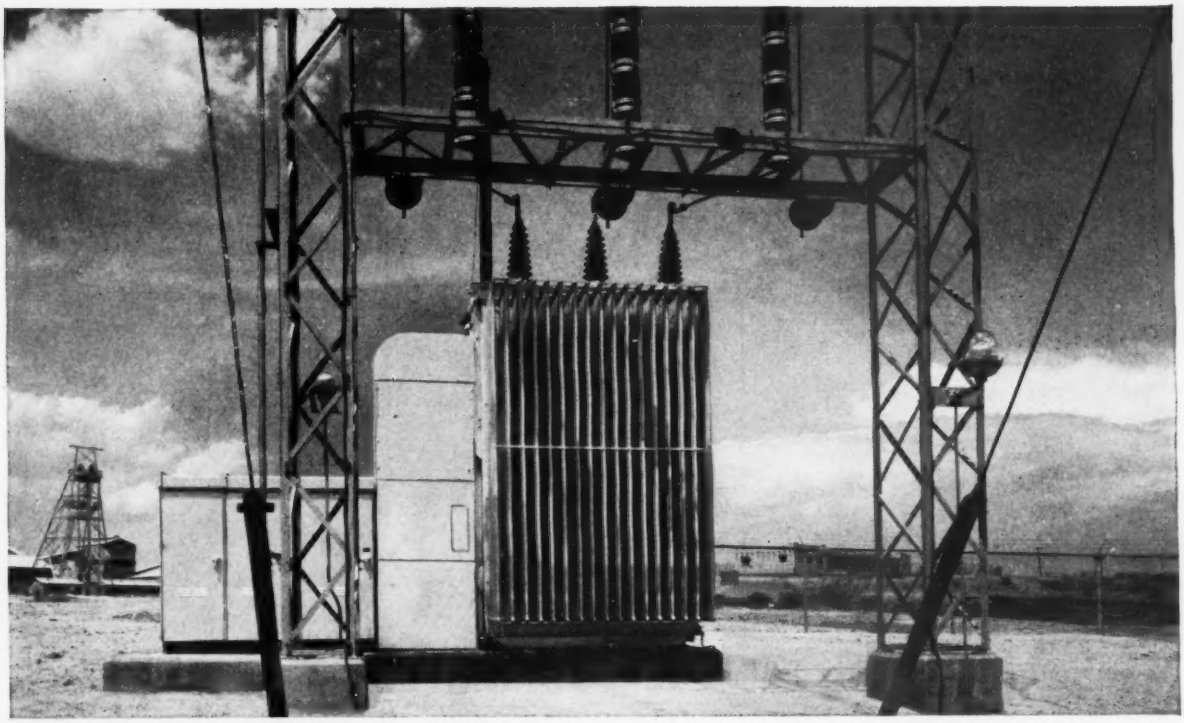


INDUSTRIAL INSTALLATION of G-E substation will take care of power needs of the Aviation Division of The Bingham-Herbrand Corporation, Fremont, Ohio. Many utilities recommend industrials install package substations at service entrances.



5000-KVA PACKAGE SUBSTATION is often best size for industrials. Southwestern Public Service Co. installed "building-block" unit at entrance of Duval Sulphur & Potash Co., Carlsbad, New Mexico—saved investment in unused capacity.

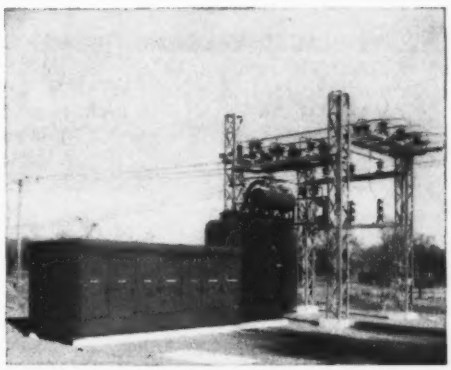
G-E package substations give utilities low-cost answer to fast-growing loads

Unit installations keep pace with greater industrial power demands

Installing new power service entrances for industrial sites—or revamping old service entrances—can become a simple, easily handled job for utilities. Whether one industrial plant or five is involved, General Electric's economical package and master unit substations can help solve problems of rapidly increasing load density.

Small package substations take care of individual plant requirements in isolated sections, and can be added to existing service installations in areas of concentrated industry. Either way, utilities can keep units economically small—only large enough to meet expected load growth—and they can avoid heavy investment in large substations with unused capacity.

Package substations reduce costs, give flexibility for shifting loads, save installation time by using co-ordinated components. For details, write for GEA-4500, "Package Substations," General Electric Company, Schenectady 5, N. Y. 882-1



IN EXPANDING INDUSTRIAL AREA, centrally located small substation of Niagara Mohawk Power Co. assures sound distribution investment.

GENERAL ELECTRIC

Corona Loss Curves for 69-Kv and 115-Kv Lines

To expedite choice of line conductors, corona loss curves covering a range of conductors for 12 elevations are presented.† Curves are based upon the empirical method of Carroll and Rockwell

M. H. COHN, Transmission Line Design Unit, Bureau of Reclamation, Denver, Colorado

Specifications

Weather: Fair; 77F

Conductor Spacing: Flat

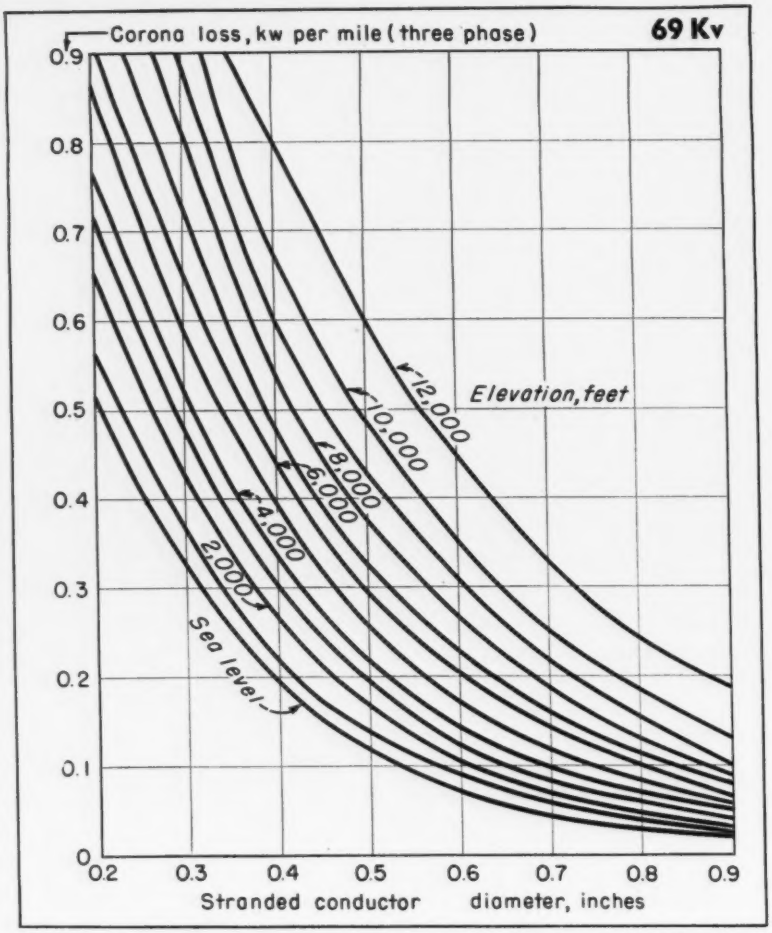
For 69 kv; 10 ft

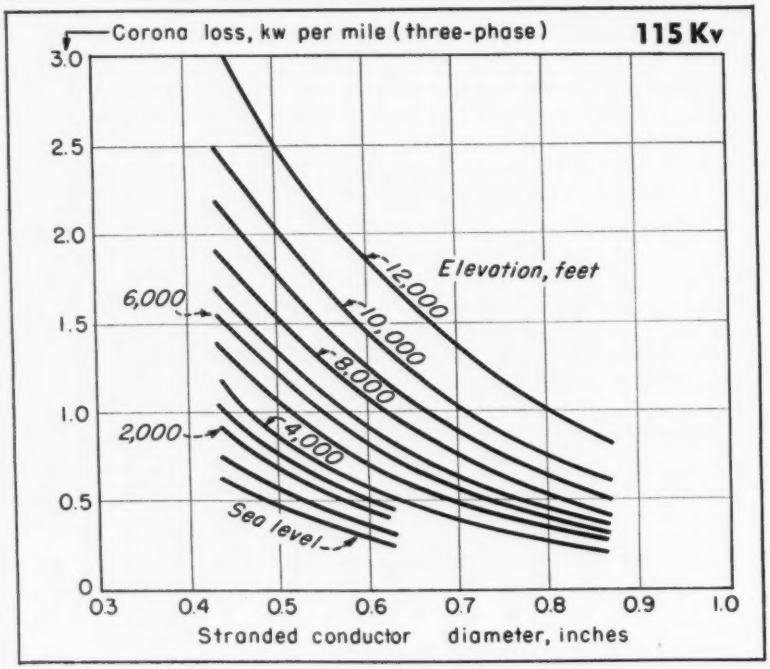
For 115 kv; 12 ft

ACSR Conductor

Size Awg or cir mil	Diameter, inches
1	0.355
1/0	0.398
2/0	0.447
3/0	0.502
4/0	0.563
266,800*	0.642
397,500*	0.783
477,000*	0.858
636,000*	0.990

* 26/7 stranding





†First in a series of three Reference Sheets. Corona loss curves for 138 kv, 161 kv and 230 kv will appear in subsequent issues.

MAIN STREET OF OAKWOOD, OHIO. LIGHTED WITH G-E FORM 206 FLUORESCENT LUMINAIRES, SETS PACE FOR WHITEWAYS OF THE FUTURE

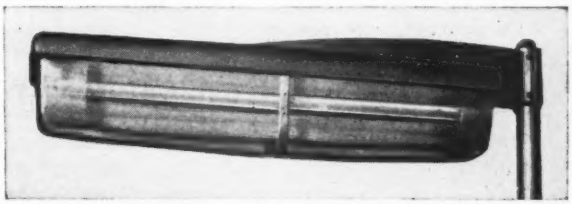
New General Electric Fluorescent Luminaire Introduces a Brighter, Broader Light Pattern

An entirely new standard of modern street lighting has been established by the new Form 206 fluorescent luminaire. Its broad, bright light pattern can make your city's busy streets the finest whiteways in the world. Its high light output is held constant throughout a broad range of temperature. This means you'll get effective lighting in any weather and during all hours of darkness. The new six-foot "Rapid Start" G-E fluorescent lamps are designed specifically for outdoor operation. They require no starters, have no starting flicker, and light within a second after being turned on.

NEW EASY INSTALLATION. Designed for speed, simplicity, and economy of installation, the Form 206's bracket is an integral part of the fixture. It requires no guys, trusses, or supports. The entire unit, including bracket, weighs about 100 pounds, and is less than seven feet long.

NEW ECONOMICAL MAINTENANCE is assured with lamps rated 7500 hours. The completely enclosing plastic globe, hinged at one end, swings down and remains in position for fast, easy, servicing.

FOR MORE INFORMATION contact your nearest General Electric Sales Office or write for Bulletin GEC-963, Section 452-133C, General Electric Co., Schenectady 5, New York.



MODERN APPEARANCE of aluminum housing and clear plastic globe adds beauty to your city's streets. Clean appearance is made possible by internal wiring and internal ballast mounting.

You can put your confidence in—

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Portable Instrument Checks Breaker Performance

FRANK KUNZE, Chief Inspector, Electrical System, Detroit Edison Co, Detroit, Mich.

New procedures are now being being used to test 34.5-kv breakers on the Detroit Edison system. Old standard test procedures were found inadequate for the compressed air circuit breakers now in service. The design and physical arrangement of the Westinghouse Type CA breakers is one of the reasons for the change.

Essentially, this type of breaker consists of a two way operated piston driving a rotating shaft to open and close a "U" shaped moving contact. The power contact opening is coordinated with the opening of a mechanically operated blast valve, allowing air under pressure to flow to the blast tube and across the opening contacts.

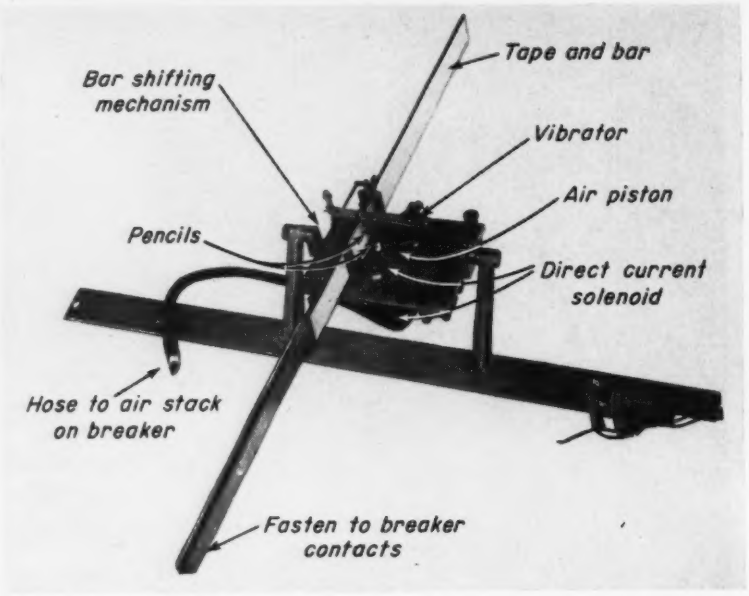
Operational tests for this breaker mechanism call for:

1. Checking air pressure protective devices for proper operation.

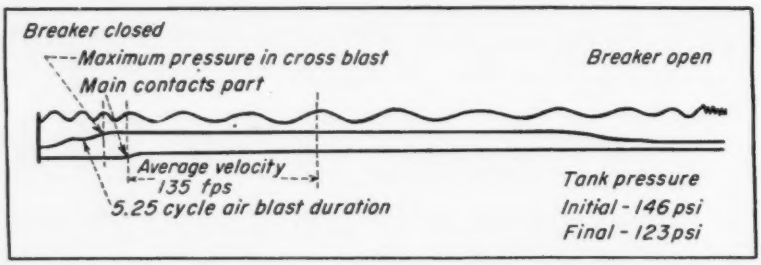
2. Timing opening and closing of breaker contacts, at both normal and low pressure operation.

3. Measuring pressure rise in blast tubes, recording the pressure at which contacts separate, and timing the duration of the air blast.

A portable instrument has been developed expressly for the third test. It consists of a travelling bar with an attached recording tape and three elements which operate pencil tracers. One element, connected to a 60-cps source, provides a timing wave. Another element responds to air pressure in air-blast tubes. The third element responds when breaker contacts open or close. Analysis of the element traces affords a check on the proper functioning of electrical, pneumatic, and mechanical operations of the breaker.



PORTABLE TESTER checks speed and time characteristic of moving contacts, responds to air pressure, and indicates when contacts make or break



TAPE RECORDING shows contact motion versus time, pressure slope and duration, and moment of contact opening or closing. Analysis of traces affords check on breaker operation

Transformer Site Design Lowers Plant Fire Risk

J. C. DAMON, Jackson & Moreland, Engineers, Boston, Mass.

Special fire hazard consideration was given to a transformer installation at Raytheon Mfg Co's new plant in Waltham, Mass. This was brought about by the high concentration of transformer capacity and the importance of maintaining uninterrupted service.

Four 1,725-kva, 13,600-600-v, oil-insulated transformers were mounted in an area 50 ft 8 in. by 22 ft 11 in. outside the plant to provide service. Engineers of the manufacturer, Associated Factory Mutual Fire Insurance Co, and the consultant organization worked out the following installation details:

All wiring was installed in conduit or bus duct.

Transformer units are mounted on concrete, surrounded by 18 in. of crushed stone. This is sufficient to absorb all oil in the transformers if it should spill out. Below the foundation is 18 in. of free draining gravel for additional drainage capacity. Outside the wire fencing is an oil retainer curb 10 in. high to protect the installation against any vehicular impact.

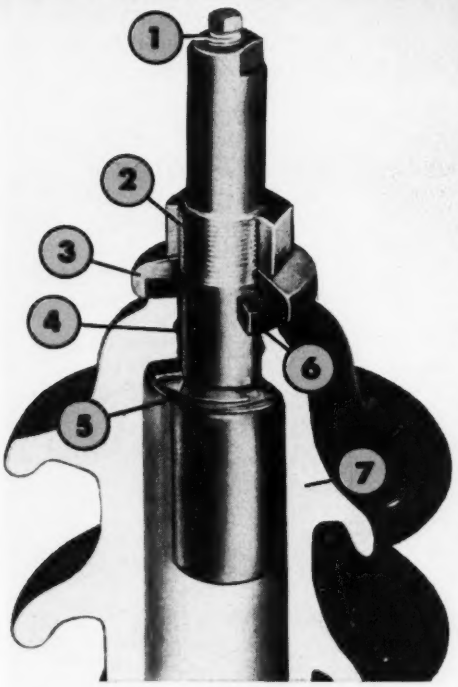
Barriers between units match the building construction and are carried up 4 ft in concrete, the same level as the building foundation. Brick is laid on the concrete to a total height of 9 ft 6 in. above ground level. This is 18 in. above the top of transformers. Barriers are 9 ft long, 8 in. wide,

DELTA-STAR "Sealcap" TERMINATORS

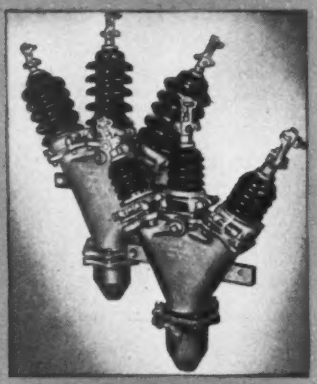
SEAL CABLES PERMANENTLY. Vented for voidless compounding. A special type seal at top of terminator developed by Delta-Star engineers permits air to escape freely when pouring compound and prevents breathing of air from which moisture may condense during the life of the terminator thereby causing failure.

GIVE LONG TROUBLE-FREE SERVICE. A synthetic rubber, oil resistant gasket fits snugly on the stud and in retainer between clamping nut and porcelain. Gasket is held in all directions and patented spiral interleaved washer inside of bushing insures life of material as gasket ages.

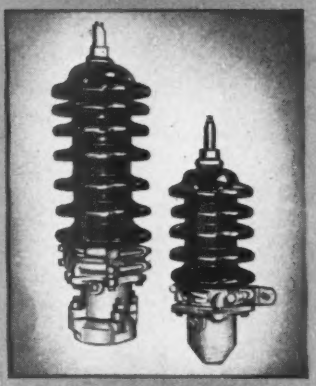
REDUCES RADIO INTERFERENCE. Hole in top of porcelain has cast metal alloy bushing which compensates for minor imperfections and reduces radio interference.



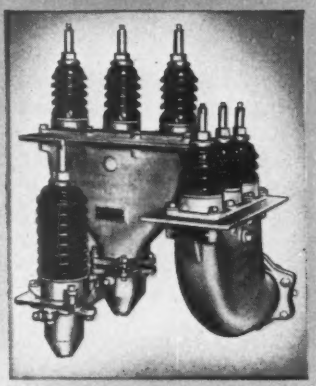
1. Vented for voidless compounding.
2. Drawnut threads carry no current.
3. Retainer prevents flow of gasket.
4. Bushing reduces radio interference.
5. Compensation for loss of resilience.
6. Oil-resistant synthetic rubber gasket
7. Extra heavy shock resistant porcelain bushings.



Three-Conductor Sealed Type Indoor and Outdoor Terminators. Refer to Publication 5303.



Single-Conductor Sealed Type Indoor and Outdoor Terminators. Refer to Publication 5211.



Single and Multiple Conductor Sealed Type Equipment Terminators. Refer to Publication 5010.

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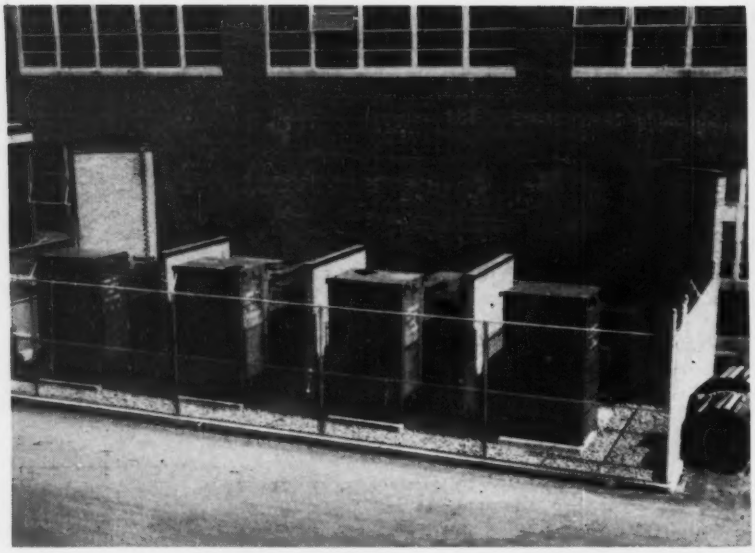


TRANSFORMER FIRE BARRIERS between each unit and at the transformer area ends as well as oil draining stone around and under the foundation lower the fire risk at this plant

WORKING SPACE is liberal between wall and throat, connecting transformer and cubicle

and spaced 11 ft 4 in. apart on centers.

Wing walls protect the building windows near each end of this outdoor transformer group and are part of the building construction. They are brought out first at right angles to the wall and then swung outward to meet the fencing, at an angle of about 45 deg. Plant windows above the bank are so high that no further protection appeared necessary.

Standard Test Set Checks Varhour Meter Phase Angles

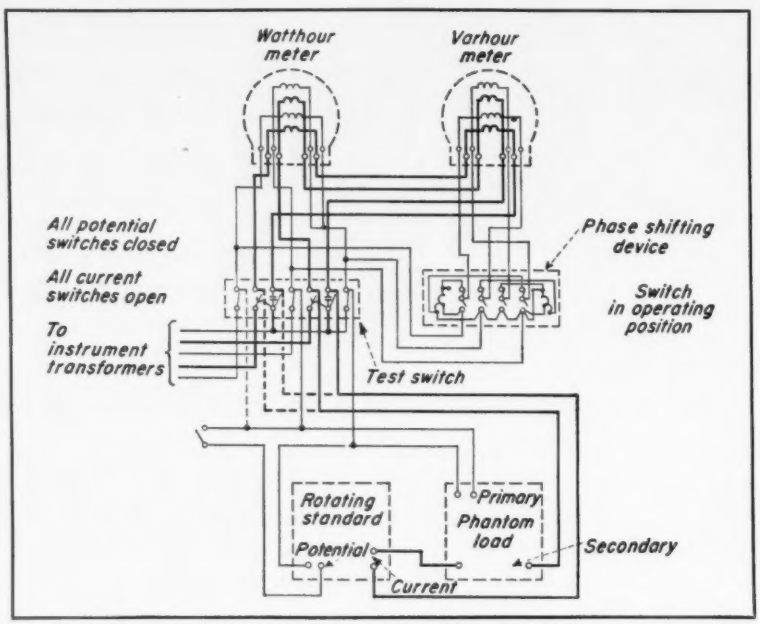
CHARLES VAN LUVANEE, Electrical Technician, De Sabla Division, Pacific Gas & Electric Co, Storrie, Calif.

Phase angles of voltages supplied to potential coils of varhour meters are checked quickly and accurately by a method using a standard meter test set. This eliminates testing with phase angle meters, wattmeters and phase sequence indicators, and takes only 30 sec compared to 15 min required by former methods. Tests are accurate for all meter installations where voltage supplied to the varhour meter must lag those supplied the watthour meter by 90 deg.

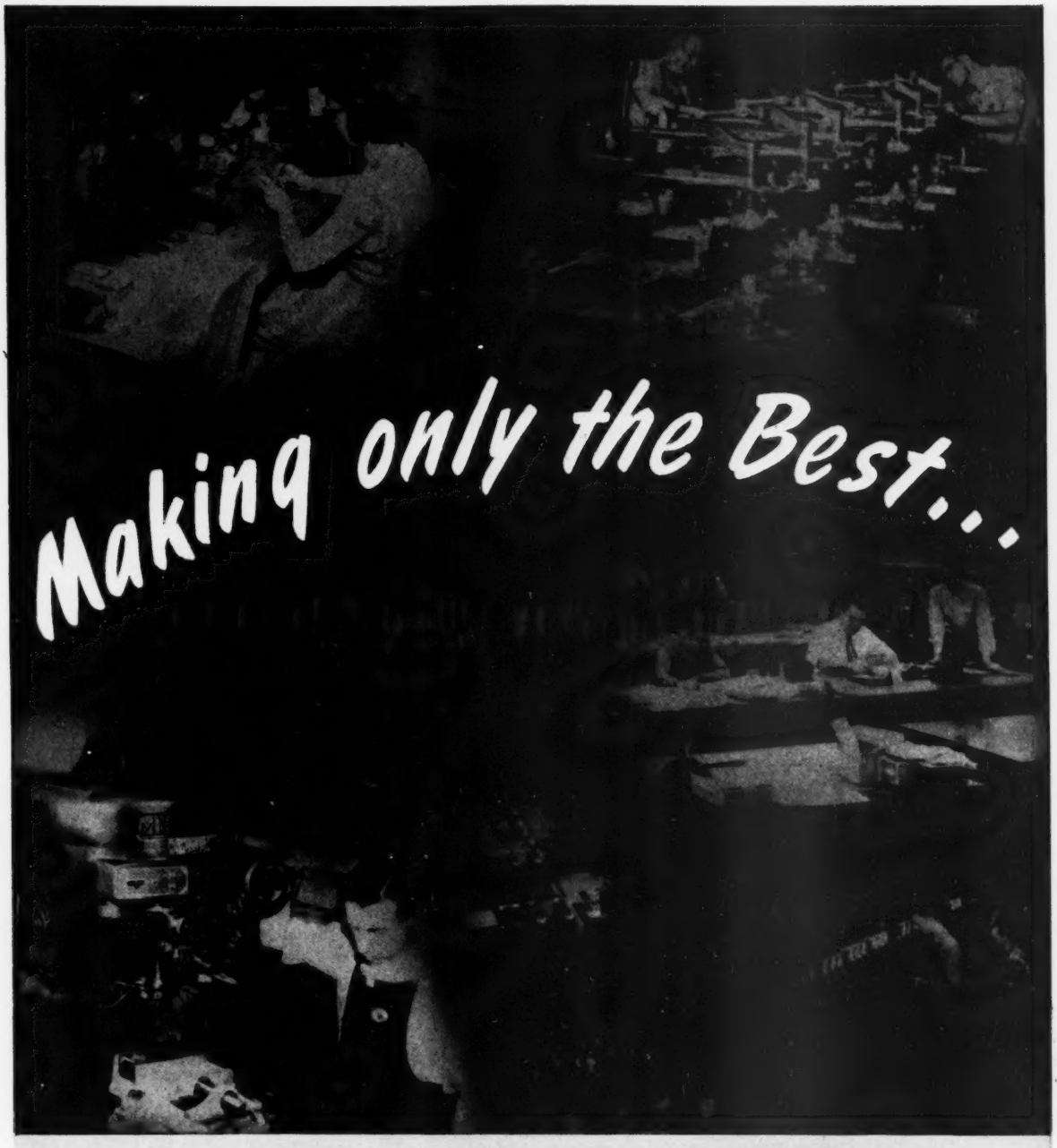
Shown in the accompanying diagram is method of connecting test set for phase angle check of a standard three-phase, three-wire watthour and varhour meter installation. One phase or element is tested at a time; therefore, solid lines indicate connections to be made for testing right-hand element. Dotted lines indicate connections for testing left-hand element. Rotating standard is not required in this method but it is left connected because it would not be convenient to remove it from the circuit.

To perform the test, rotating standard is set on 5-amp or higher range and 5-amp load is applied from phantom load. If connections to meters are correct, and phase shifter is operating properly, the following conditions should result:

1. Watthour meter will rotate at one-element full-load speed.



TEST CONNECTIONS for checking right-hand element of varhour meter are shown by solid lines, dotted lines for testing left-hand element. Voltage test also is required



Oil and Air Circuit Breakers • High and Low Voltage Switchgear
Unit Substations • Instruments • Precision Balances
Watthour Meters • Disconnect Switches • Outdoor
Hook Stick Switches • Air Break Switches
Indoor and Outdoor Bus Supports
Bus Ducts • Substations

ROLLER SMITH

ROLLER-SMITH CORPORATION AND ELPECO DIVISION

BETHLEHEM, PENNSYLVANIA

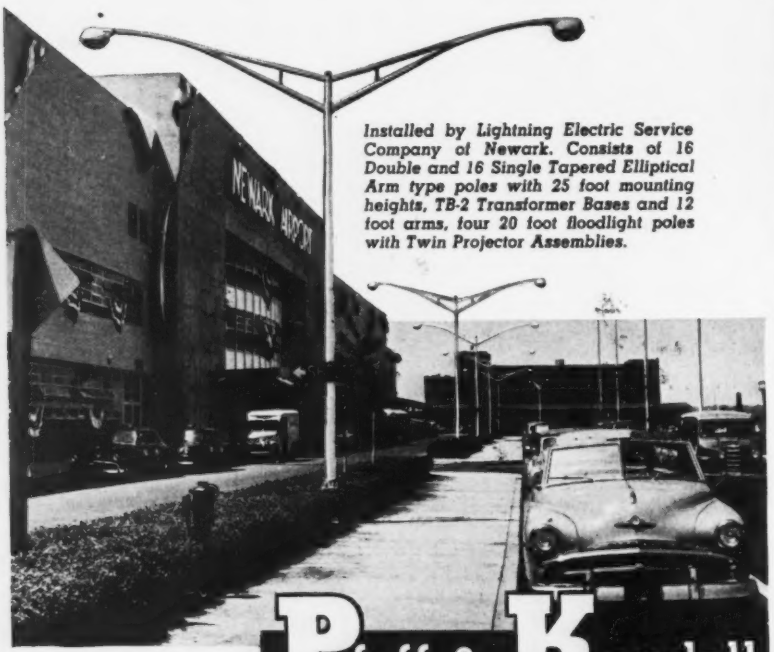
ELPECO

the P&K Story at Newark Airport

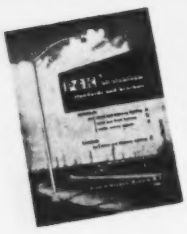
Newark Airport, celebrating its twenty-fifth anniversary this year, has become synonymous with commercial aviation. Today, it covers 2,300 acres in Essex and Union Counties, New Jersey . . . ten minutes from the heart of Newark and twenty-five from mid-town Manhattan. It is truly an important part of the center of world air transport.

Recent extensive modernization conducted by The Port Of New York Authority has made the Newark Airport unsurpassed in every facility that contributes to convenience and efficiency in handling of all types of civil air traffic.

Pfaff and Kendall considers it a privilege to have been selected to help in Newark Airport's modernization. The P & K All-Aluminum Standards and Brackets, in their clean, functional design, are in perfect harmony with both the new dress and new efficiency of world-famous Newark Airport.



Installed by Lightning Electric Service Company of Newark. Consists of 16 Double and 16 Single Tapered Elliptical Arm type poles with 25 foot mounting heights, TB-2 Transformer Bases and 12 foot arms, four 20 foot floodlight poles with Twin Projector Assemblies.



Pfaff & Kendall
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Newark 5, New Jersey

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and use the P & K Planning and Advisory Services without obligation.

2. Varhour meter will rotate very slowly forward.

Slow forward rotation of varhour meter is produced by a slightly lagging current due to inductive reactance in meter current coils. Test is repeated for each element. Finally, voltmeter should be used to determine that voltages on corresponding elements of both meters are of same magnitude.

Folding Hoist Speeds Oil Filter Changing

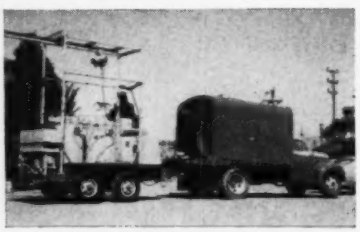
GEORGE YOUNG, Idaho Power Co, Boise

Folding overhead hoist on a mobile oil-reclaiming unit allows crews of Idaho Power Co to change filters in the field with speed and convenience. Hoist can be raised to a 14-ft operating position in one minute. It folds to maximum height of about 8 ft to eliminate any problems of clearance.

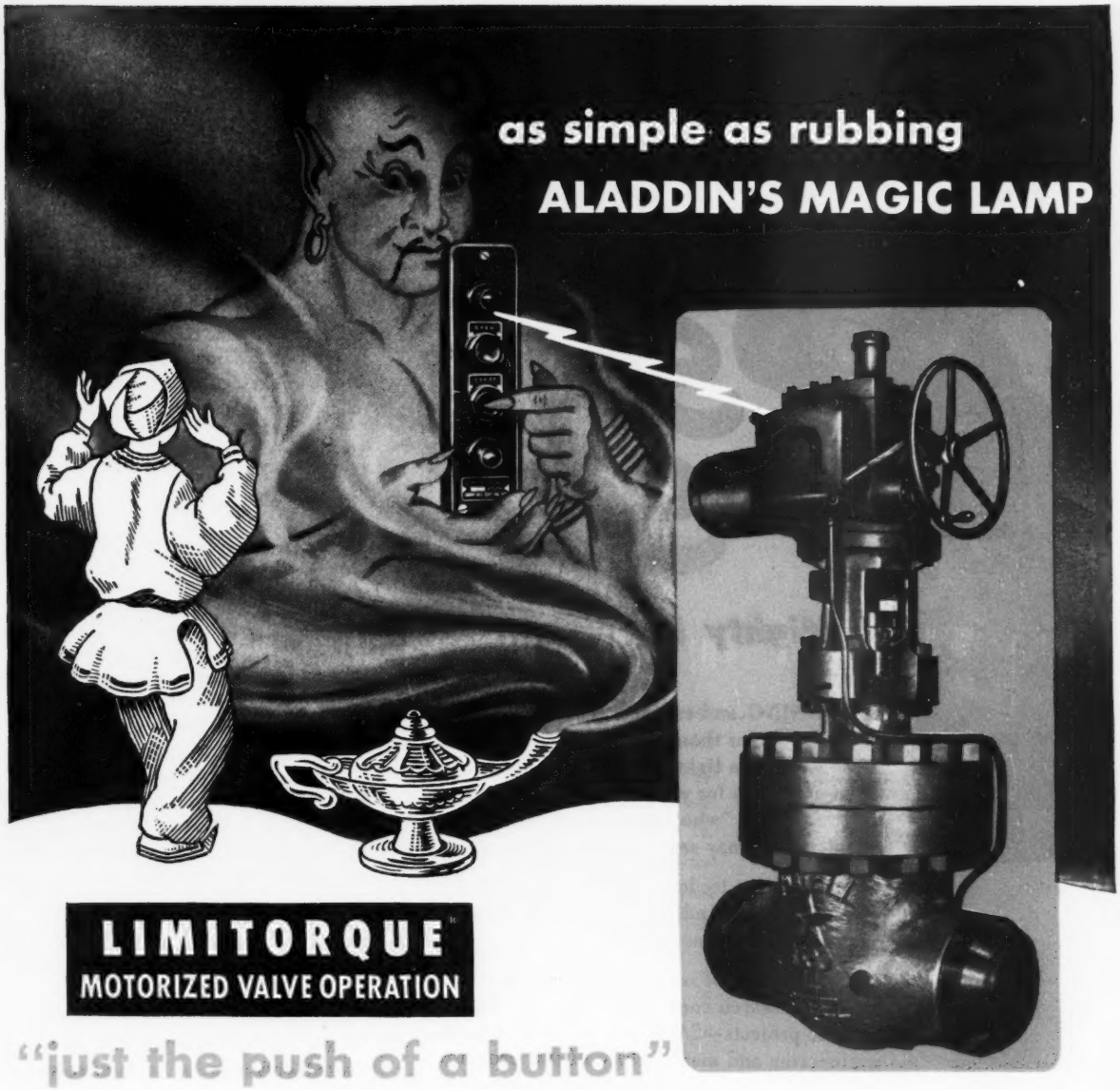
FOLDED HOIST has 8 ft maximum height to meet road clearances for travelling

Hoist consists of four-leg structure, monorail unit, and hydraulic lifting mechanism. Legs are joined with a steel pin about midway in their length to allow structure to fold forward. In raised position, each leg locks in place with a second steel pin. Legs also are attached with pins at the bracing rod and at the monorail supporting structure to allow the assembly to fold.

Electrically operated hoist travels



IN RAISED POSITION electric hoist on monorail lifts weight of a sludged filter unit



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Hardly less magical than the rubbing of a lamp, accompanied by a few mysterious incantations—is the opening and closing of huge valves under high pressures, in remote places, or even miles away—by the MERE PUSH OF A BUTTON. Yet, that is the magic of *Limitorque* Valve Operation—safe, sure, dependable, accurate—and without the possibility of any damage to valve stem, seat, or disc.

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"Who Says So?"

is Mighty Important!

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A survey of your hazards by CARDOX puts this experience at your service. It can be of great value to you—and it costs you nothing. Why not write for a CARDOX *survey* now?

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ORIGINATOR OF LOW PRESSURE CO_2 FIRE EXTINGUISHING SYSTEMS

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on overhead rail, the ends of which have a steel plate welded across them to prevent hoist from leaving rail. Capacity of hoist is over 1,200 lb, or about maximum weight of sludged filter unit. Rail extends 32 in. beyond extreme end of trailer to provide plenty of working room when changing filters.

Lifting mechanism consists of a hydraulic piston which raises and lowers the hoist structure. Piston is operated by a motor-driven pump mounted on the oil supply tank. A valve controls lowering of structure. Hoist was designed in company's machine shop at Boise.

Tips on Starting Gasoline Standby Engines

F. E. ROTENBERRY, Claytor Hydro Plant Supervisor, Appalachian Electric Power Co, Pulaski, Va.

Aviation (octane 80) or marine grade gasolines, both "gum" inhibited; frequent starting; and Monel fuel tanks are significant requirements for reliable starting of standby internal-combustion engines. Starting is not dependable with ordinary automotive gasolines if engines stand idle for a considerable period. Trouble is caused by dirt in the carburetor, lead deposited from leaded gasolines, or gum deposits that foul the carburetor.

Different gasolines have been tried with the following experience:

1. Automotive leaded gasolines would not start a standby engine started only once a week after one year.

2. White automotive non-leaded gasolines were somewhat better but still unsatisfactory.

3. Aviation Grade 80 gasoline was tried and trouble formerly experienced disappeared.

4. Gasoline developed for winter operation is more volatile than summer gas and permits easier starting.

5. Marine white gasoline has been used successfully after long storage and has very low gum content.

During World War II an inhibitor was developed that prevented gum deposit in gasoline when kept in storage a long time. Regardless of gasoline or inhibitor used, gasoline should be drained from tanks in Spring and Autumn, and tanks refilled.

(*Continued on page* 179)

HI-TENSION NEWS *Junior*

New levels of apparatus protection and arrester durability

Now offered by Thorex Multi-Purpose, Type MP

Compared to previous station-protective arresters, the Thorex Multi-Purpose offers a reduction of 10% to 15% on IR discharge voltages. This is coupled with exceptionally low tolerances of +5% on IR discharge voltage and +10% on series gap sparkover voltage. The result is a new order of wide protective margin between maximum arrester performance and minimum apparatus insulation strength.

•

Thorex Multi-Purpose arresters provide generous thermal capacity for the rigorous service imposed by long, high voltage networks, large underground cable installations, and heavy static capacitor banks, where long-duration disturbances may be encountered. They likewise excel in lightning-protective performance. These arresters pass all American technical standards for heaviest duty, not only with ease but with great un-used reserve.

•

Throughout the entire voltage range from 3 kv to beyond 300 kv, Thorex Multi-Purpose arresters are self-supporting. Elimination of bracing structures is a material economy in the higher voltages.

•

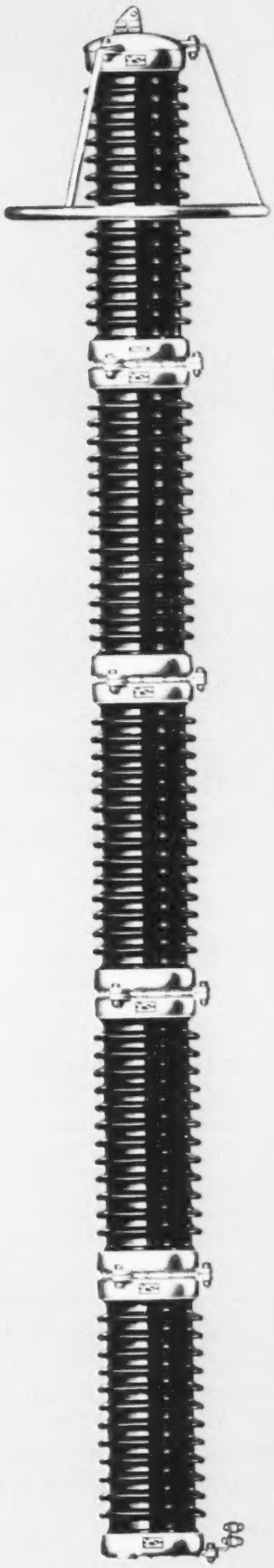
Extensive new research has been expended in the design of radically improved valve blocks of high thermal capacity, an ingenious and novel spark gap with unusual interrupting ability, and internal grading provisions at higher voltages to offset the otherwise adverse effect of semi-conductive surface contamination.

•

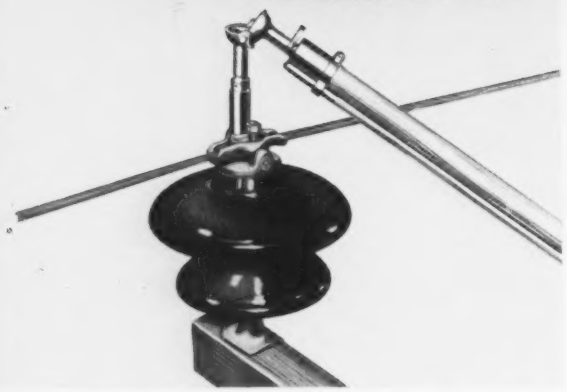
Thorex Multi-Purpose, Type MP, lightning arresters now offer you hitherto unattained levels of apparatus protection and arrester durability. Your O-B representative is prepared to discuss their many possibilities with you.

Ohio Brass

MANSFIELD, OHIO, U. S. A.



HI-TENSION NEWS *Junior*



Clamptops handle with hot line tools in, possibly, as little as half the time of a conventional tied insulator, providing—(see next picture)

—providing the clamp is free to slide along the conductor for re-positioning at the new insulator location. This feature is inherent in the O-B design.

You don't have to "tinker" with O-B Clamptops

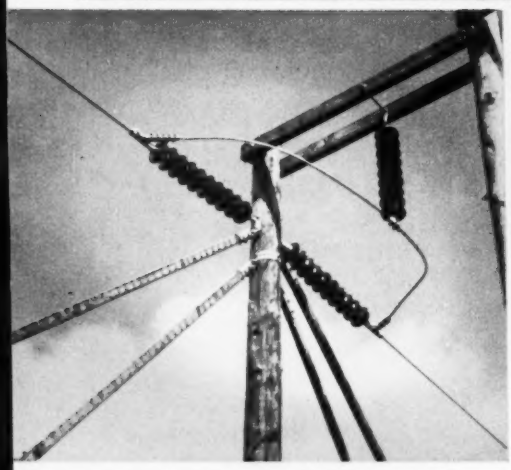
Have you ever thought much about the *second time* you may work on your insulators? Pole, crossarm, conductor, or insulator damage may call for a "hot" change-out. The basis of most hot line work is disconnecting and reconnecting the conductor and insulator. How well does a given insulator handle?

Simplest of all insulators to work hot, and safest, is the Clamptop. Lacking just one feature, however, all this simplicity would disappear. The clamping piece must be free to slip on the conductor to "re-register" with the new position of the insulator top—and this position always changes, at least slightly.

With the O-B Clamptop, the act of disconnecting it from its insulator automatically loosens its hold on the conductor. The clamp is free to re-position. Later, one tightening operation completes attachment to the insulator and grips the conductor simultaneously.

Only a hot-line workman might think about this detail that can make or break a clamping type insulator design but, to him, easy re-positioning of the clamp is the difference between a simple job and endless tinkering with his hot stick—tinkering that costs real money, at best, and that may be a near-impossible job.

When you buy Clamptop insulators, pintypes or posts, remember that O-B has been through years of pioneer development and experience with this design. For a practical, workable, and adequately tried-out Clamptop, specify O-B.



Get rid of bolted jumper connectors and the trouble that goes with them

With O-B Hi-Lite Strain Clamps you string through strain locations with continuous cable

Here are only *a few* advantages you get with using O-B Hi-Lite strain clamps: low cost—simple, quick installation requiring only a common hand wrench—reliable holding power—easy, positive inspection for the life of your line. But, the foregoing are just a "bonus."

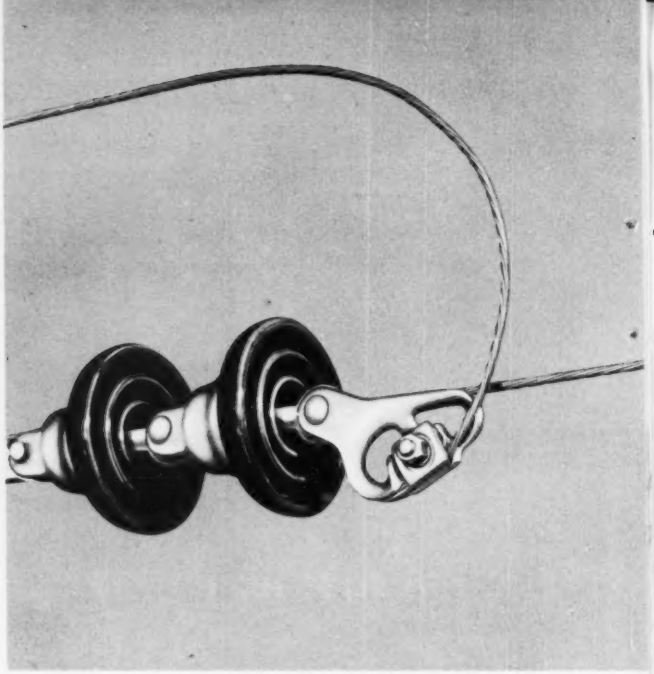
Here is the big story! The conductor need never be cut to build a deadend with Hi-Lite clamps. The only splices in the line are between reels. Such tension splices are inherently reliable—in contrast to bolted jumper connectors, which are subject to corrosion, heating, and sometimes to failure.

If this advantage of continuous-cable jumper construction cost you extra money, it would be well worth while in terms of higher line reliability. The fact of the matter is you get it along with a lot of other welcome features—lower clamp cost—lower installation cost—less time spent at deadend points—and a basically sound clamping practice from every angle.

Try the Hi-Lite strain clamp for yourself and you'll find we have *still* under-stated the story.

Ohio Brass

MANSFIELD, OHIO, U. S. A.



Save a lot of trouble –at no extra cost

Buy these O-B Distribution Materials from your local Graybar warehouse

You can buy these and other distribution line materials direct from O-B, but there's an easier way.

At established l.c.l. prices, Graybar Electric Company will deliver O-B materials right to your receiving dock or collection point. You haven't had to carry them in inventory or maintain paper work to keep up stocks. A lot of hidden costs can be saved, and there's no premium on the selling price.

Graybar will gladly work with you to establish adequate local supplies of desired O-B items, and the pooling of these with other nearby power company requirements assures a comfortable "cushion" to meet emergency demands—more than you could wisely afford to set up single-handed.

It costs no more dollars, and a whole lot less trouble, to buy your O-B distribution materials locally—through Graybar.

Distributed by Graybar Electric Company

Ohio Brass

MANSFIELD, OHIO, U. S. A.

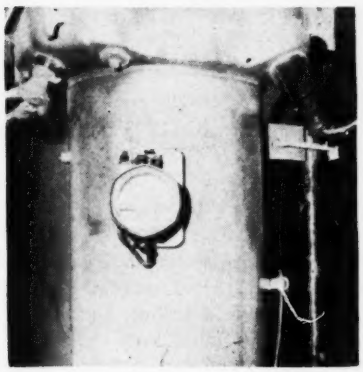
4403-H

Starting Standby Engines

(*Continued from page* 174)

Frequent starting of internal-combustion engines, at least once a week, helps to keep them in proper operating condition. It minimizes mechanical deterioration due to internal rusting. Even starting a standby engine once a week does not use the gas before its useful life has run out. Recommended length of time for the Aviation Grade 80 gasoline to be stored is from three to six months.

The fuel tank on gasoline engines operated infrequently should be of Monel metal or treated on the inside so that it will not be susceptible to rusting. Experience indicates that Monel tanks are probably the best for standby engines that do not operate long.



CONTACT THERMOMETER held by magnets to transformer shell, is easily placed or removed without tampering

Transformer Thermometer Attaches Easily

Checking transformer oil temperature by use of a contact thermometer held by magnets to the shell permits direct readings without removing cover at Gulf States Utilities Co, Baton Rouge, La. It can be quickly placed on transformer and easily removed.

Thermometer is adjusted so that oil temperature can be read direct from shell temperature. (Difference is about 15 deg.) Method has proven so effective that company does all oil temperature testing with it.

Contact thermometer is held to transformer shell by two 40-lb permanent magnets, one placed vertically and the other horizontally. This arrangement is necessary to prevent vibration causing thermometer to "walk down" transformer side.

AT DUSK...

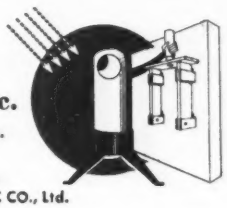
...FISHER-PIERCE PHOTOELECTRIC CONTROL

When street lighting is controlled by Fisher-Pierce, lights *automatically* turn on the instant that natural light intensity falls below a safe level . . . regardless of time of day, season, climate or weather conditions. And, at dawn, lights remain on until natural light is sufficient for safety. No matter how modern your street lighting is, it is not adequate unless the lights are *on whenever natural light is insufficient for safety and protection.*

Fisher-Pierce Photoelectric Controls have been proven by the experience of hundreds of utilities — proven for performance, for technical operating features and for true economy.

When you consider augmenting or modernizing your street lighting, get in touch with Fisher-Pierce. The extensive Fisher-Pierce engineering service organization is at your service.

Write for Bulletin 63300C.



The FISHER-PIERCE CO., Inc.
82 Pearl St., So. Braintree, Boston 85, Mass.

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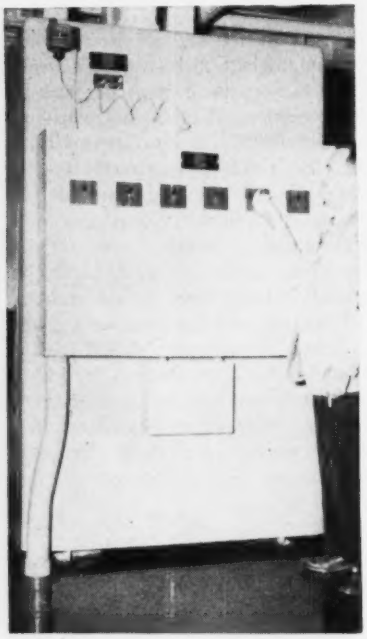
IN CANADA: NORTHERN ELECTRIC CO., Ltd.

KITCHEN is all-electric with load of 160 kw in ovens, ranges, fryers, etc., serving 500-seat dining room open every day in week including Sundays



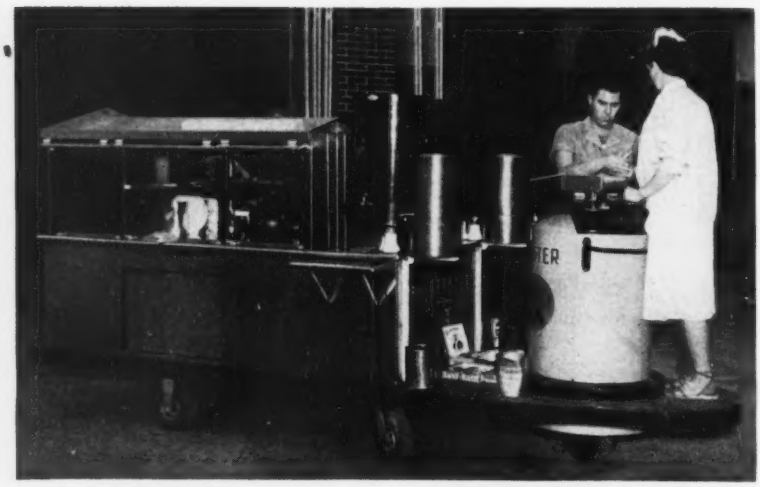
WATER HEATER provides ample hot water for the locker room washing facilities

All-Electric Facilities Build Employee Morale

L. B. REED, Industrial Heating Consultant, Los Angeles Dept of Water & Power, Los Angeles, Cal.

McGulloch Motors Corporation's one million dollar recreation building, with its cafeteria, bowling alleys, and theater, is an excellent example of what can be done to build employee morale and keep them comfortable and happy by means of electricity.

This modern and attractive recreation building is entirely devoted to and run by the employees. Beautifully landscaped, with an attractive patio, it is the mecca of employees after working hours. The first floor contains dining facilities seating 500 persons, a snack bar, and an all-electric kitchen. Here delicious and moderately-priced meals are prepared every day of the week, including Sundays. The second floor contains a small theater, completely equipped for showing sound pictures. The lounging deck is also on this floor. Six bowling alleys and the locker rooms are in the basement.

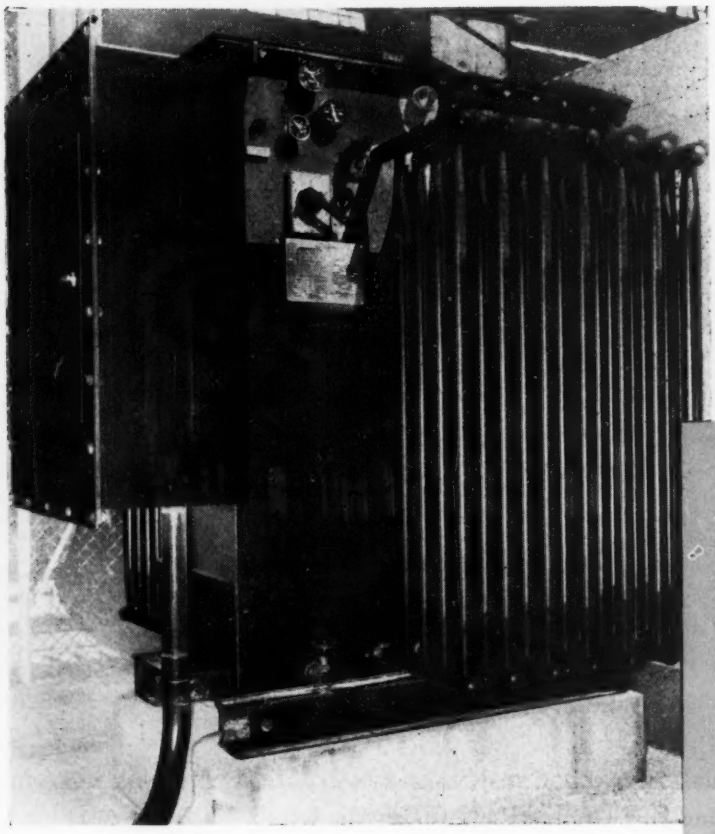


MOBILE SNACK BAR (one of several) eliminates congestion in plant cafeteria during meals and coffee breaks. They have electric heating and refrigerating units. Receptacles for this equipment are located at various stations in the plant

The kitchen is fully equipped with baking ovens, ranges, deep fat fryers, etc., and is far superior to most kitchens in better restaurants. Connected load of kitchen equipment is 160 kw. Ample piping-hot water is provided for the building requirements by two 150-kw boilers. Comfort heating is provided by 308 kw of strip heaters (102-3-kw and 4-500-w) located in the ventilating ducts and 100 hp of air conditioning is provided to insure comfort.

To eliminate congestion in the cafeteria during coffee breaks, several mobile snack bars are used. Various stations in the plant are provided with the necessary electrical receptacles for the heating and refrigeration units of the mobile snack bar.

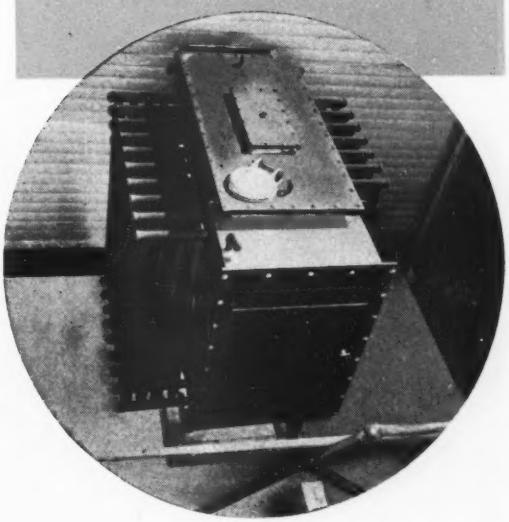
(*Continued on page* 184)



at Maywood Chemical Works

Uptegraff POWER TRANSFORMER helps speed expansion program

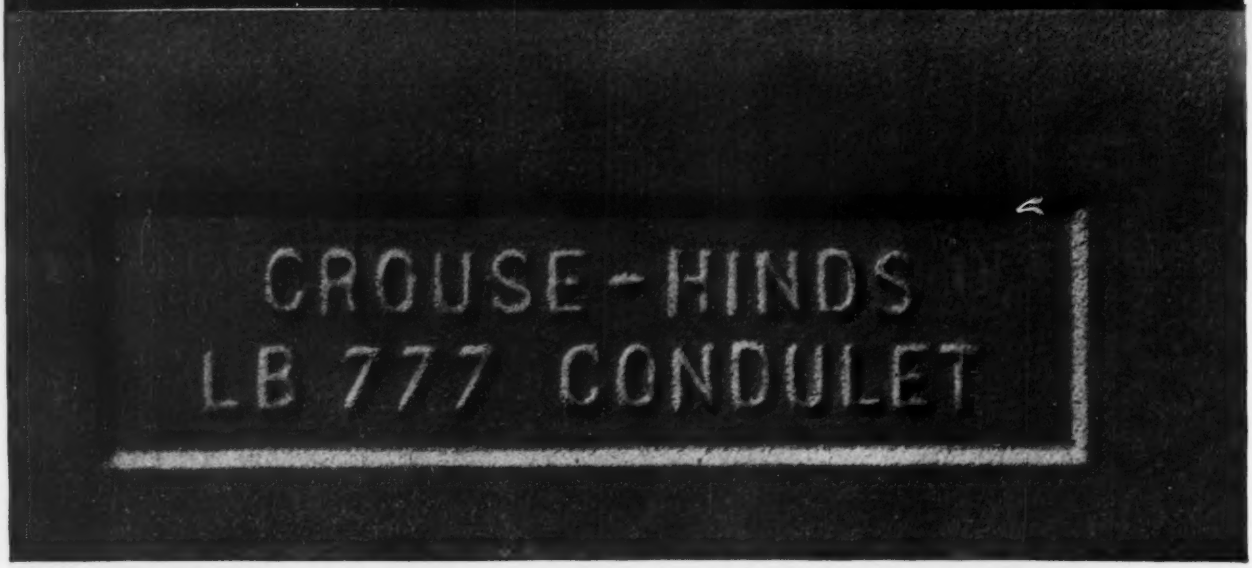
When additional electric power was needed to serve expanded facilities of the Maywood Chemical Works, Uptegraff was able to furnish the required type of transformer and meet the delivery deadline. The photographs show two views of this transformer, a 750 KVA Power Unit, 4160 Grd.Y/2400 —480 Delta volts, 3 phase, 60 cycle. It includes provisions for adding thermometer controls to actuate cooling fans on radiators if needed for future load increase.



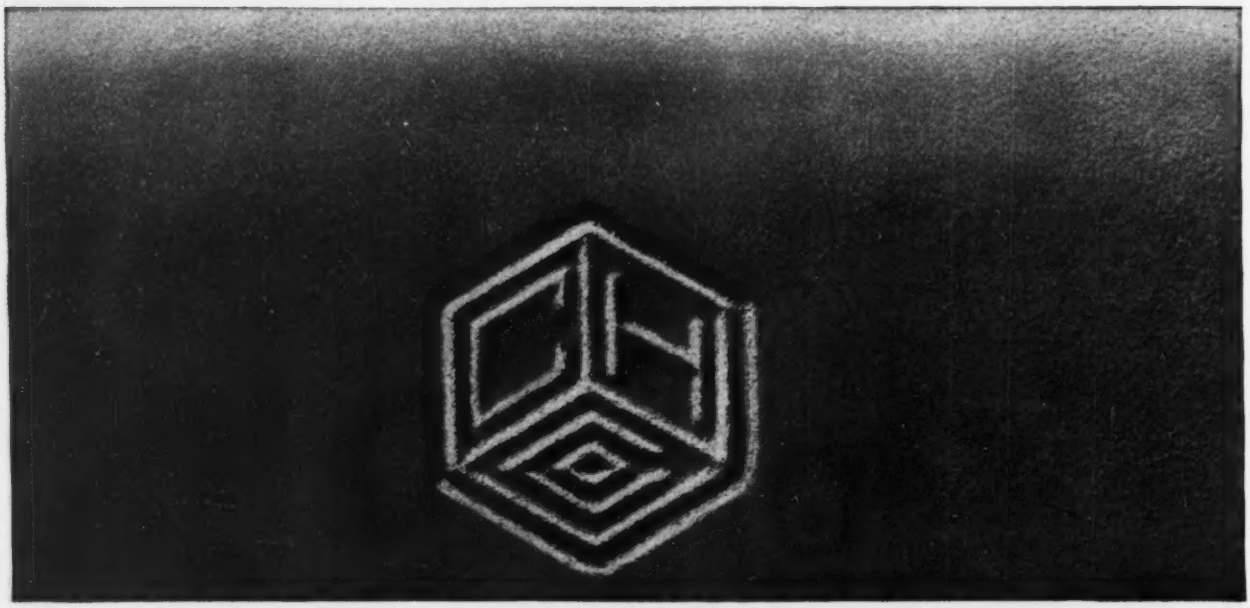
Bird's Eye View
shows the clean, open construction of radiators, with large cooling area and ample space for cleaning and painting.

R. E. UPTEGRAFF MANUFACTURING CO.
SCOTTDALE, PENNSYLVANIA

When you ask for



Enlarged view showing how Crouse-Hinds trademark CONDULET is cast right into the body of Condulets for your protection. No other manufacturer can use this trademark.



Enlarged view that shows how the Crouse-Hinds Company cube trademark is cast into the body of Condulets or other Crouse-Hinds products. This is an assurance that you are getting Crouse-Hinds quality.

CONDULETS · TRAFFIC SIGNALS

CONDULETS... be sure that you get CONDULETS*

There is no substitute for CONDULET quality

CONDULETS have always been of the highest quality. To maintain its position of leadership Crouse-Hinds has a large Engineering Dept. constantly developing new products to add to the CONDULET line and improving old ones. Crouse-Hinds foundry and factory have the latest mechanical improvements and modern machinery. This enables the highly skilled craftsmen to turn out a product that is tops in quality. Constant checking and testing proves that this is true.

When CONDULETS were introduced by Crouse-Hinds in 1905 they completely revolutionized electrical conduit installation practice. This newly invented line of conduit outlet bodies was so superior to anything else on the market that all electricians were soon using them. They were of such high quality that many of those early installations are still in use . . . in tip-top condition.

When imitations appeared on the market, it isn't a bit surprising that many people called all conduit fittings Condulets. Of course, we appreciate this compliment, but it often leads to confusion. It can be very disappointing if you think you are getting CONDULETS and later discover that the installation was made with a product of some other manufacture.

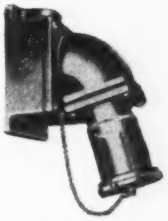
CONDULET is not a common noun. It is a coined word registered in the U. S. Patent Office and designates a product made only by Crouse-Hinds Company.

You can be sure of getting CONDULETS by buying from one of Crouse-Hinds authorized electrical distributors. They are ready to serve you throughout the country. Ask for CONDULETS. Then look for the word CONDULET or the C-H Co. cube trademark on the body. These trademarks appear on every genuine CONDULET.

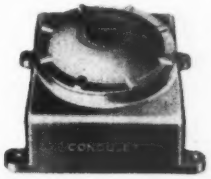
Type LB
Obround Condulet

Type EVA Explosion-Proof
Lighting Fixture

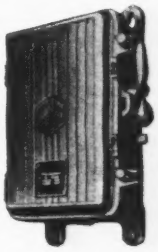
Type GUAC Explosion-Proof
Junction Condulet



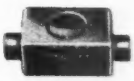
Type AREA
Plug Receptacle



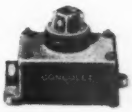
Type GUB Explosion-Proof
Junction Condulet



Type WMK Watertight
Safety Switch Condulet



Type FSC Tumbler
Switch Condulet



Type EFS Explosion-Proof
Pilot Light Condulet

When you ask for Condulets
be sure that you get CONDULETS

*CONDULETS are made only by CROUSE-HINDS

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

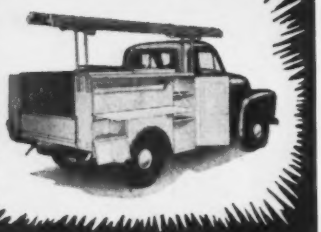
OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston
Indianapolis — Kansas City — Los Angeles — Milwaukee — New Orleans — New York — Philadelphia — Pittsburgh
Portland, Ore. — San Francisco — Seattle — St. Louis — St. Paul — Tulsa — Washington.
RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Charlotte — Corpus Christi — Reading, Pa. — Richmond, Va. — Shreveport
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

CONDULET
First in the field
STANDARD OF QUALITY

A Nationwide Distribution Through Electrical Distributors

FLOODLIGHTS · AIRPORT LIGHTING

CRAFTSMAN



SERVICE BODIES

and SIDE BOXES
...SAVE YOU MONEY!

Whether you buy Craftsman bodies built-up (ready to mount on chassis) or partially knocked-down (to save on freight costs) you get all-steel, precision welded bodies built to give you l-o-n-g service!

YET YOU PAY LESS

MAIL COUPON NOW
for complete details

EW

NAME_____

ADDRESS_____

CITY_____ STATE_____

I am interested in a service body for the following chassis:

☐ ½ TON ☐ ¾ TON
☐ 1 TON ☐ 1½ TON

I am interested in Side Boxes to convert my "Pick Up" to a Service Body. ☐

Stahl METAL PRODUCTS Inc.
3490 W. 140 St., Cleveland 11, Ohio

Electric Morale Builders

(*Continued from page* 180)

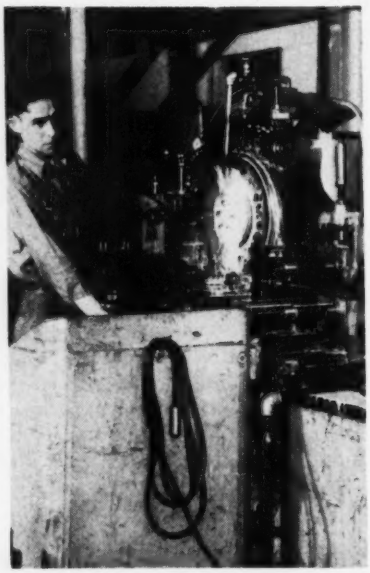
Located in the basement of the main plant, the locker rooms and tiled showers provide 40,000 sq ft of dressing space for the 2000 employees. There is a 72-kw water heater, specially built for this installation, and a locker ventilating system. All lockers are louvered and set on a concrete base. The base, which raises the lockers several inches off the floor, is flush with the sides of the lockers, and contains a duct which is connected to the bottom of each locker. All the air in the locker room is exhausted through these ducts; thus, a flow of fresh air is constantly passing through each locker. The locker room is fresher, and the working clothes well aired.

Resistance Heating Ups Tubing Output

L. ALBERTSON, Application Engineer, Philadelphia Electric Co.

Metal tubing is produced at speeds up to 150 ft per min by a machine at the Welded Tube Co of America, Philadelphia, Pa. Rapid production is made possible by high speed continuous resistance heating that fuses the seam, a method which surpasses arc or torch welding for uniformity and saving of time and money. Speed of production is in relation to gauge of metal and diameter of tubing being processed.

Structural type tubing is produced chiefly for manufacturers of modern furniture. It is processed in a machine where a strip of hot or cold rolled carbon steel, 13 to 20 gauge, is fed to rollers which first curl it into tube form and then bring it into contact with electrodes which quickly fuse it. With the seam fused, the tubing passes through a die which draws it to desired diameter, ranging from ½ to 2 in. It is then automatically cut in desired lengths and dropped into a storage rack. Use of machine was so successful that firm installed additional one of 300 kva to produce tubing up to 4 in. in diameter.



METAL TUBING production is increased by 100-kva resistance heating machine which fuses seam at speeds up to 150 ft per min.

Electropolishing for Stainless Steel

Polishing stainless steel is done electrically at Victory Plating Co, Cheviot, Ohio. Electropolishing is electroplating in reverse. Products to be polished are used as the anode in a d-c plating tank. Metal is removed from the product being polished.

To provide necessary d-c power for electropolishing, company has gone to the use of dry plate rectifiers as follows:

2—1000-amp and 1 - 750-amp, magnesium-copper sulphide dry plate rectifiers.

2—500-amp, copper oxide dry plate rectifiers.

All rectifiers are 6-v d-c output; 240/480-v, 3-phase, 60-cycle input.

Company finds that dry plate rectifiers are much more satisfactory than M-G sets since they require very little maintenance, there are no moving or rotating parts to wear, and there are no brushes to replace and no commutators to turn, undercut, and polish. Regulation of input voltage enables dry plate rectifier units to deliver a constant d-c output voltage regardless of whether the supply voltage is high or low. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

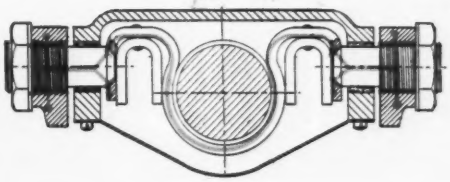
NEW CHANCE type H Rotating Stack Switch

For 7.5 through 230 KV 400-600-1200 Amperes

Switching operations on today's heavily loaded power systems demand rugged switches that are simple in design and have the ability to give years of unfailing performance—without maintenance—under any climatic condition.

Chance Type H Outdoor Group Operated Airbreak Switches meet these demands—they have only three moving parts . . . break heavy ice accumulations with ease . . . have high pressure contacts at both ends . . . completely enclosed hinge connection . . . permanently lubricated or dry type ball bearings and are equipped with universally adaptable controls for installation on any type of structure.

Chance Type H 7.5 to 69 KV Single Pole Design

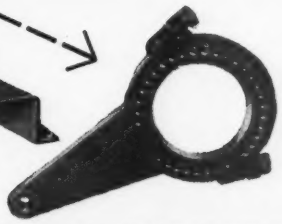


Continuous Hinge Contact

The contact at the hinge end of ALL Type H Switches is held under constant high pressure in both open and closed position. Contacts are never released—thus contact area is never exposed to oxidation or corrosion. This diagram shows the current path at the hinge end of the switch. The heavy U-shaped beryllium copper pressure springs carry no current, support no weight. Contacts are completely enclosed.

Universal control for easy installation

Chance Type H Switches are equipped with a universal control crank, with screw point recesses at 10° intervals. This crank makes it easy to adjust the controls to within 5° of any position and permits the control mechanism to be readily adapted to any type of structure.

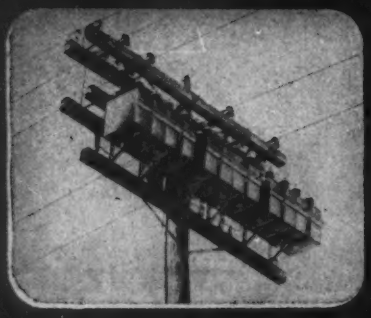


C53-3A

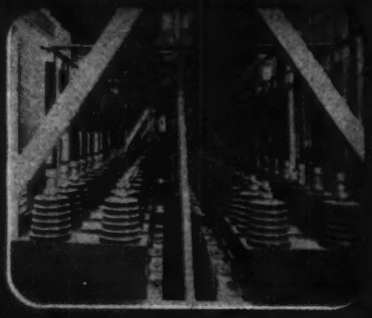
Write for complete information on these new group operated switches.

A·B·CHANCE CO·

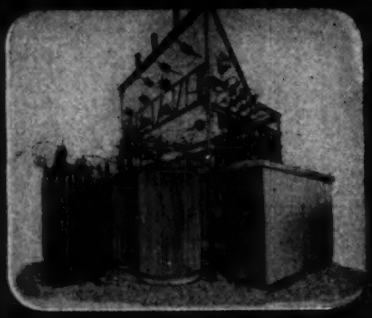
CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA



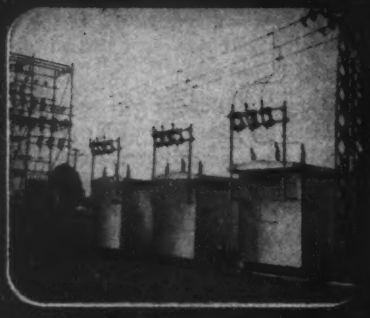
1939



1942



1945



1946

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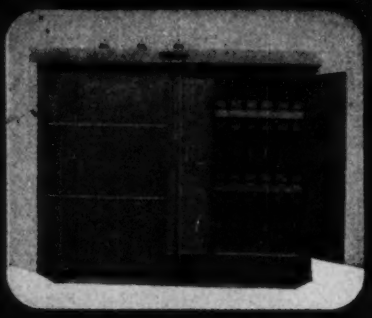

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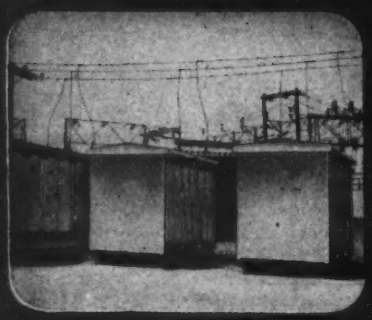

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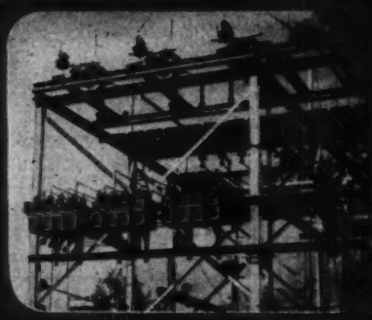

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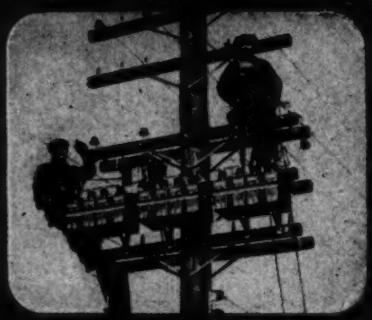

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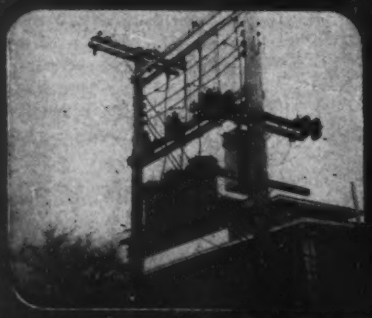

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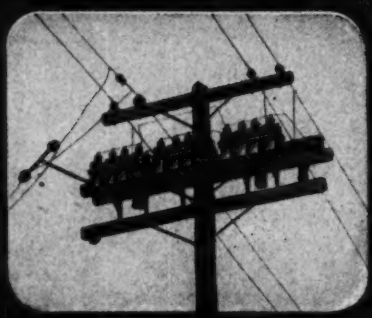

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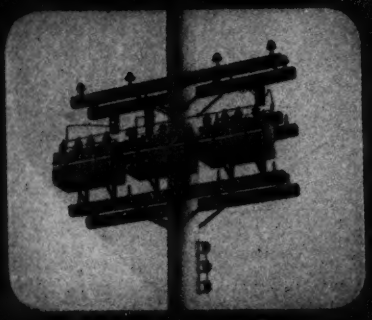

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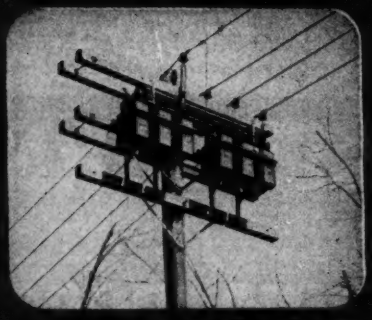

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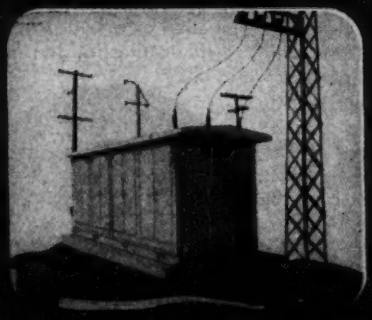


1946

the Years write an impressive testimonial to Cornell-Dubilier Capacitors

You will find them in the stations and on the poles of the country's largest power producers: C-D capacitors that have been in continuous operation since 1938, 1939, 1940 with *little or no maintenance required!* Over 4,000 time-tested C-D installations confirm that this is truly the most *consistently dependable* capacitor for power-factor improvement.

C-D gives you these extra safety factors

- C-D capacitors are designed to withstand transient over-voltages as well as steady state voltages. Low dielectric unit stress provides this extra margin of safety.
- Heavy major insulation in the form of laminated liners with reinforced corners, insures highest impulse withstand levels.
- Only C-D capacitors (from 230 to 13,800 volts), are subjected to a full rated voltage energization test.
- Wide margin between paper and foil provides higher insulation level.
- Use of C-D's Dykanol results in lower unit weight per KVAR; high stability; long life.
- Heavy-Duty wet process porcelain bushings for longer creepage path, less breakage, higher impulse rating.

Planning an installation of industrial, station or pole-type capacitors for power-factor improvement? You can save maintenance dollars and insure trouble-free service by talking it over with a C-D engineer. Cornell-Dubilier Electric Corp., Dept. D-93, South Plainfield, N. J.

CONSISTENTLY DEPENDABLE

CORNELL DUBILIER

CAPACITORS

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, AND CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C.; AND SUBSIDIARY, THE RADIART CORP., CLEVELAND, OHIO

Here's the whole POINT of our story!

. . . that BLACKBURN Copper-Bonded Ground Rods Assure You Efficient, Permanent Grounding

BLACKBURN *Copper-Bonded* GROUND RODS

They are completely covered, including each end, with a heavy uniform coating of pure copper, molecularly bonded, to fully protect the steel-core. (See small illustration) For ease of driving, they have a hard drawn, rigid steel core, and are rolled-finished to produce a hard scar-resistant surface.

BLACKBURN Ground Rods are stocked by leading wholesalers, who are backed by a stable, dependable factory source, strategically located in the Middle West, for quick shipments to all parts of the country — **Insist on BLACKBURN.**

JASPER BLACKBURN CORPORATION

35 Madison St., St. Louis 6, Mo. — Phone CEntral 3007

Distributed on the West Coast by KORTICK Manufacturing Co.

INDUSTRIAL BRIEFS

Drying sand with electric strip heaters at the U. S. Plug & Fitting Co of Canton, O. saved over 34 tons of metal in 1 yr compared with formerly used process. Company experienced considerable trouble with standard molding procedures in producing accurate molds for plugs. Shell molding process was tried unsuccessfully. Problem of drying molding sand which contains a 5% phenolic resin, was solved by installing 6 kw of electric strip heaters on bottom of main plate. This system permits curing of each mold on face plate surface in required time of 20 sec. Results are so satisfactory that company plans installation of five more of these devices. T. C. Sterb, Comm. Sales Rep., Ohio Power Co., Canton.

Inspection lighting with black light shows effectiveness of fungus resistant material sprayed on truck wiring at Mack Mfg. Co, Allentown, Pa. Ordinary inspection methods could not determine if wiring was sufficiently covered with the sprayed material. By mixing fluorescent paint in the spray material, the examination under black light is made very effective. Paul Britt, Industrial Representative, Lehigh Div, Pennsylvania Power & Light Co, Allentown.

Offsetting prevention while printing has been effected by use of infrared lamps at Mason's Inc., Savannah, Ga. Certain kinds of inks under certain weather conditions caused offsetting while printing. Use of 4 - 250-w infrared lamps in a home made bracket over the receiving bed of the press dried the ink sufficiently on the printed matter to prevent costly rejects because of offsetting. Another similar installation has been made on a second press. C. D. Anderson, Power Sales Engineer, Savannah Electric Power Co.

Ink drying and **static removal** with 8 kw of infrared radiant heat on the horizontal press at Seiders Printing Co, replaced an open flame gas burner which had created a serious fire hazard. Better working conditions have resulted. Vincent Smith, Industrial Representative, Pennsylvania Power & Light Co, Schuylkill Division.

OFTEN THERE'S NO SUBSTITUTE FOR A GOOD LOOK

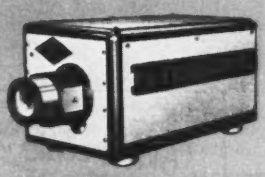
That's Why Industry Needs the DIAMOND "UTILISCOPE"

(WIRED TELEVISION)

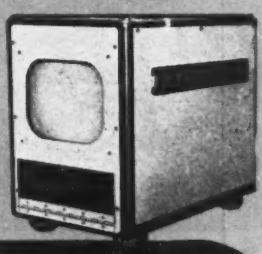
Vital and critical processes inside a furnace often are of such a nature that only a good look can make sure the conditions are right. There are many other operations and processes in industry where the statistical information offered by the best instrumentation is no substitute for a good look . . . places where instruments can't provide the REALISM necessary to correct judgment and decision.

The Diamond "Utiliscope" (wired television) enables the operator to have a "good look" at all times, no matter how distant, dangerous or inaccessible the operation. A clear image can be brought to any desired point. Images of separate but related operations can be shown side by side, so one operator can correctly coordinate them.

The "Utiliscope" is thoroughly reliable and not expensive. It cuts costs, improves operation, saves manpower and promotes safety. Write for Bulletin.



"Utiliscope" Camera (above) and Receiver (below)



TYPICAL USES—Studying destructive tests of engines • Watching flow of molten steel • Checking remote gauge readings • Observing conditions inside furnaces • Viewing nuclear research • Coordinating materials flow on conveyors • The "Utiliscope" (Registered U. S. Patent Office)

DIAMOND "UTILISCOPE" WIRED TELEVISION

WRITE FOR BULLETIN 1025W

DIAMOND POWER SPECIALTY CORP.

FIRST IN INDUSTRIAL TELEVISION

LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES

Diamond Specialty Limited—Windsor, Ontario

6191

SINCE 1903, DIAMOND HAS MANUFACTURED QUALITY EQUIPMENT FOR INDUSTRY

Part of Shell Oil Company's modern Houston, Texas refinery

CUSTOMER is shown the trouble and told what is required to correct it

Clearing House for Wiring Problems

Detroit Edison service men work with Electrical Association's contractor pool to handle troubles promptly

Detroit customers are being helped with their inadequate wiring problems promptly when they're in trouble. Naturally, that is when they are most receptive to an adequate wiring sales story.

The program, launched early this year, is a simple one.

Detroit Edison's service men, who replace blown fuses, and repair electric ranges and other appliances frequently find the real trouble is in the wiring.

In the past customers were advised to get in touch with a wiring contractor. That wasn't much help if the customer didn't know where to find a contractor on whom he could depend for competent advice on rewiring to fit his needs.

Favoritism Avoided . . . To solve the problem, and avoid the appearance of favoring any contractor, the Electric Association of Detroit set up a clearing house for handling all calls of this type.

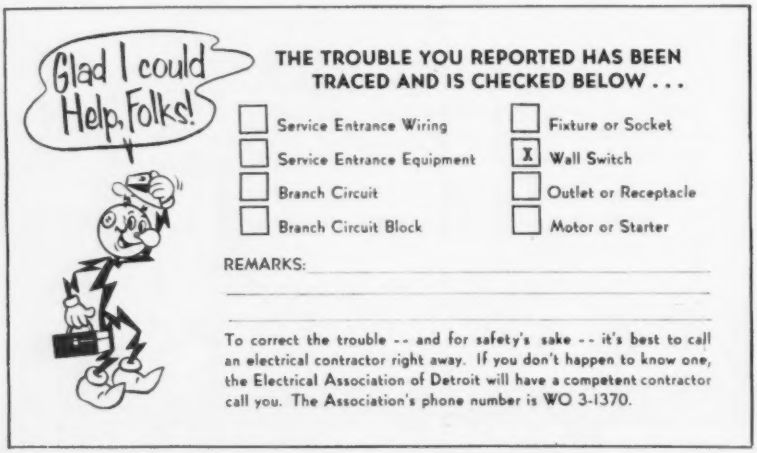
When Detroit Edison service men, or others in the company, get inquiries of this nature, they refer the customer, either verbally or by a referral card, to the Electric Association's clearing house.

When the customer calls the Association office he is assured that a qualified contractor will call or see him within 24 hours. The inquiry is then referred to a contractor who is participating in the program and who is in the vicinity of the customer making the inquiry. This assures reasonable travel time for the contractor and convenience and economy for the customer.

Inquiries are referred to contractor members of the Joint Council of Electrical Contractors participating in the program with Detroit Edison and the Electrical Association. Contractors agree to reasonable prices, high quality work, and to answer inquiries promptly.

In the first six months, 839 customers were referred to the clearing house. Of these, 421 had work done, and 151 were undecided.

Contractors reported job sales on 217 of the 421 calls on which work was done. The jobs were reported to average $43.27 each.


Glad I could Help, Folks!
THE TROUBLE YOU REPORTED HAS BEEN TRACED AND IS CHECKED BELOW . . .
Service Entrance Wiring
Service Entrance Equipment
Branch Circuit
Branch Circuit Block
Fixture or Socket
X Wall Switch
Outlet or Receptacle
Motor or Starter
REMARKS:
To correct the trouble -- and for safety's sake -- it's best to call an electrical contractor right away. If you don't happen to know one, the Electrical Association of Detroit will have a competent contractor call you. The Association's phone number is WO 3-1370.

REFERRAL CARD gives customer the nature of the trouble and where to get the job done

Westinghouse, Emerson To Join Air Cooling Field

The Westinghouse Electric Corp will re-enter the field of room air conditioning with a completely new line of small units in 1954, according to an announcement by H. F. Hildreth, manager of refrigeration specialties for the company's Electric Appliance Division. Westinghouse has been out of the field since 1942.

Joining them will be the Emerson Radio & Phonograph Corp, which will put its first air conditioning units on the market "well in advance of the summer of 1954," according to Benjamin Abrams, company president. The line will consist of four models and will be introduced at distributors' meeting early next year.

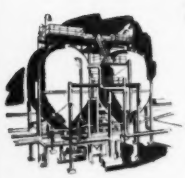
SINCE 1903, DIAMOND HAS MANUFACTURED QUALITY EQUIPMENT FOR INDUSTRY

Part of Shell Oil Company's modern Houston, Texas refinery which processes 125,000 barrels of crude oil daily.

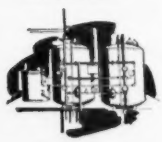
PERMUTIT ION EXCHANGERS

deliver highest purity makeup for SHELL

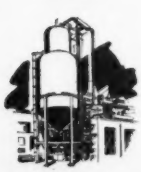
BOILERS in this enormous Shell refinery operate at 650 psi. Steam output is received by turbo-generators . . . exhausted to process. ¶ To insure continuous steam turbine operation—for greater efficiency and more economical production—Permutit Demineralizing Equipment treats makeup water. The ion exchange units at right have a continuous capacity of 96,000 gph. ¶ The raw well water supply contains high total dissolved mineral solids—324 ppm, a harmful amount of silica—13 ppm. Its total hardness is 70 ppm, methyl orange alkalinity 230 ppm. ¶ This installation—a Permutit Two-Step Demineralizer with Degasifier—removes virtually all dissolved mineral solids. Silica is reduced to under 0.2 ppm. The effluent is purer than most distilled waters, costs much less to produce. Most important, costly shut-downs from heavy scale on turbine blades are prevented. ¶ Permutit makes all types of ion exchangers and water conditioning equipment . . . can save you time and money in the specification of the one combination that best suits your needs. ¶ For aid in solving your own water problems, write to The Permutit Company, Dpt. EW-9, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.



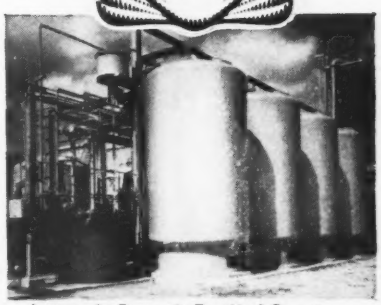
Sludge Blanket Hot Lime Soda



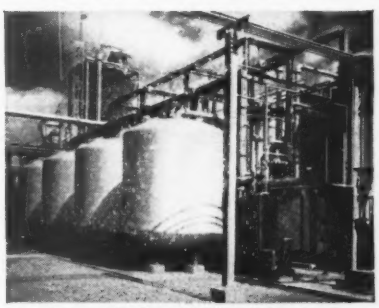
Hot Zeolite-Permutit Q



Deaerating Heater



Automatic Permutit Zeo-Karb® units remove metallic cations from Shell's well water supply. Effluent passes to Degasifier at right for low cost CO_2 reduction.



Automatic Permutit S units remove remaining troublesome mineral impurities by anion exchange.

PERMUTIT®

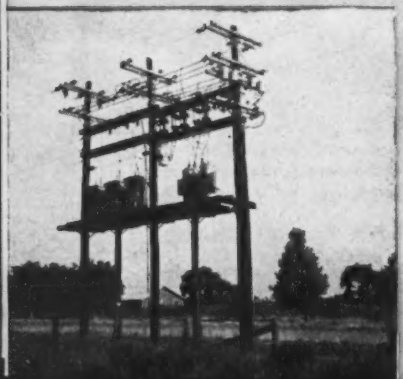
ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

HOW TO MAKE A BETTER JOINT

Follow these 4 Operations

Protect service continuity by applying the 4 operation Kearney Connection System to every tap, splice, terminal, bus fitting and ground connection on your system.

Don't risk switchgear failure due to overheating of connections. Terminal transfer surfaces need the protection of the Kearney Connection System.



Good Connections are a Valuable Investment

YOUR distribution system is no better than its connections. Loads are skyrocketing. You'll be spending thousands for larger conductors, heavier switchgear, more substation capacity . . . and yet, *one high resistance, overheating joint can wreck all your good planning.*

It just doesn't pay to take a chance. Follow the good construction practice outlined at the right. When you do this you are taking the most important step possible toward elimination of outages, lowered maintenance costs and better customer relations.

Standardize on this simple, complete KEARNEY CONNECTION SYSTEM. You'll be saving yourself money and manpower for years to come. Write Dept. K today for complete information on any or all of these *system-saving* Kearney Products.

Specify

Kearney

JAMES R. KEARNEY CORPORATION

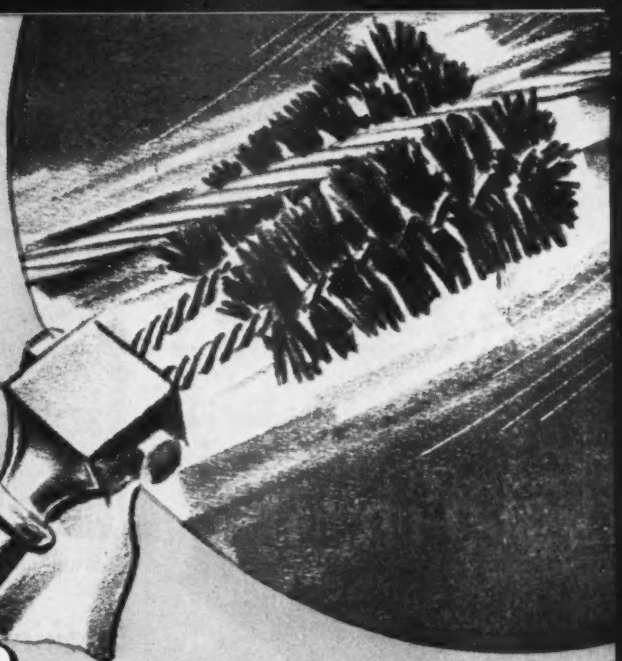
4224-42 CLAYTON AVE. ST. LOUIS 10, MISSOURI

Canadian Plant—Guelph, Ontario

JRK-237

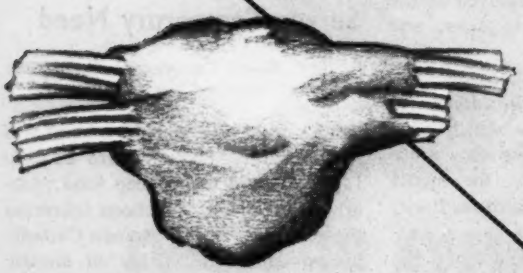
1 • CLEAN

the conductors first. Remove every trace of corrosion or oxidation in order to provide high conductivity contact. A few short strokes of the *Kearney Cleaning Brush* quickly removes all corrosion, even deep down between strands. Available with sure grip handle or with fit-on attachment for hot stick use.



2 • PROTECT

the cleaned surfaces. Copper and aluminum oxidize very quickly . . . but, KEARNALENE *Inhibitor* chemically stops high resistance corrosion before it has a chance to start. It's handy to apply; will not harm the skin or damage conductors.



4 • SEAL

out all air and moisture to guarantee lasting protection against corrosion. You can prevent trouble even in bi-metallic taps by eliminating the electrolyte. *Kearney Airseal,* a pliable, removable high-dielectric compound is quickly and easily kneaded around the connection; permanently seals out corrosion. *Airseal* is supplied in 5 convenient sizes of pads and rolls.

3 • SELECT

a connector designed for the particular job. A wide range of *Kearney Connectors* provides the exact type you need:

Con-Nec-Tite Split Bolt Connectors
Squeezon Compression Connectors
Pressurite Two Bolt Clamps
Parallel Groove Clamps
Laptite Service Entrance Connectors
High Conductivity Splicing Sleeves

PRODUCTS

For Better Construction . . . for **SAFER** *Maintenance*

The Old Reliable

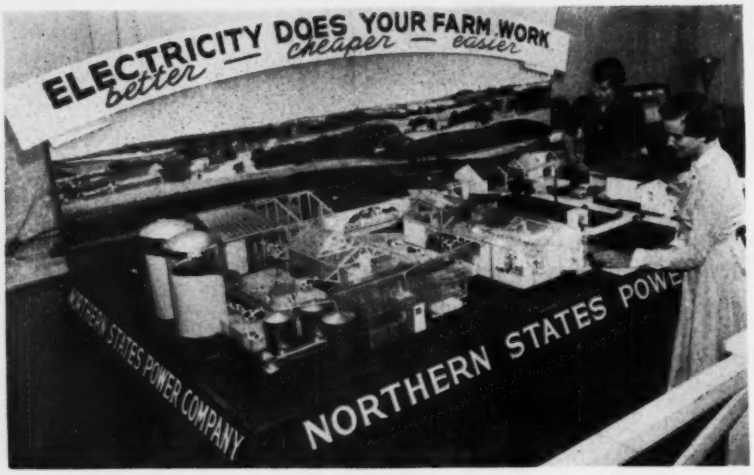
EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA



Transparent covering on Northern States equipment displays facilitates . . .

Looking Through a Model Farm

Some of the more than 300 uses for electricity on the farm are graphically demonstrated in a model electric farm which Northern States Power Co is showing throughout its service area.

Most of the labor-saving electric devices on this scale model actually operate and many revolutionary new uses for electric power are displayed.

According to C. T. Bremicker, NSP vice president in charge of sales, the mobile farm will be displayed at the state fair, many county fairs, and other rural events.

Wiring Illustrated . . . In addition to dramatizing the uses to which electricity can be put in doing work more easily and economically, the model also illustrates proper farmstead wiring.

It also shows some of the latest developments in dairy farms. It features the so-called "loose-type" housing for cattle in which cows run loose in "lounge barns" and are taken to "milking parlors" to be milked by electric milkers which feed the milk directly into coolers from which it is automatically pumped into trucks.

Another feature is the fan-driven feed distribution system. This is a series of pipes running from the shed where feeds are automatically mixed and ground, and then blown by electric fan to the feed lot, hog house, chicken house, or wherever desired. Demonstrations of the feed system have proved it is possible to blow feed at least 300 ft.

The model also shows a completely automatic water system throughout the farmstead, use of electricity for heating and ventilating, unloading silos, drying hay, and many other chores. There is also a full line of home appliances.

Emergency Installation Serves Temporary Need

E. D. P. Gross, Commercial Power Consultant, Hartford Electric Light Co

That a utility can have a heart was proven recently by Hartford Electric Light Co, which—to keep food properly warmed for a luncheon following the consecration of a Roman Catholic bishop—installed 51 kw in electric heating facilities on a temporary basis.

The food was cooked at a downtown Hartford hotel and transported to St. Joseph Community Hall for the celebration attended by 1,000 persons, prior to which an electrical contractor spent two days installing the equipment. Connections made to the 220-v secondary leads of a nearby transformer were made by cable carried through windows in the hall building.

The equipment centered on a supersized bain marie, 8 ft x 4½ ft x 2 ft, and included eight 5-kw immersion type heating units. This had been

(*Continued on page* 203)

This is Carroll Roseberry* Manager of the Westinghouse Electric Utility Department, who will take you through the following pages, all of which have an important bearing on—

How product design advances relate to system protection, investment or growth

*Mr. Roseberry, as coordinating head of the company's Electric Utility efforts, is constantly working with product division experts . . . members of the Westinghouse team . . . who devote full time to the solution of *your* basic problems.

"Here's John Carlson, Manager of Engineering, Steam Division, to tell you about the importance of one turbine component as it relates to high capital investment."

YOU CAN BE **SURE**...IF IT'S

New 25″ turbine blade . . . raises kw capacity of 3,600-rpm units 25% . . . reduces cost per kilowatt

The new 25″ turbine blade is the result of 25 years of Westinghouse development of exhaust-row turbine blading. It reflects the importance of high-quality turbine components in meeting the demand for higher unit ratings. The new blade makes still greater generating economies possible.

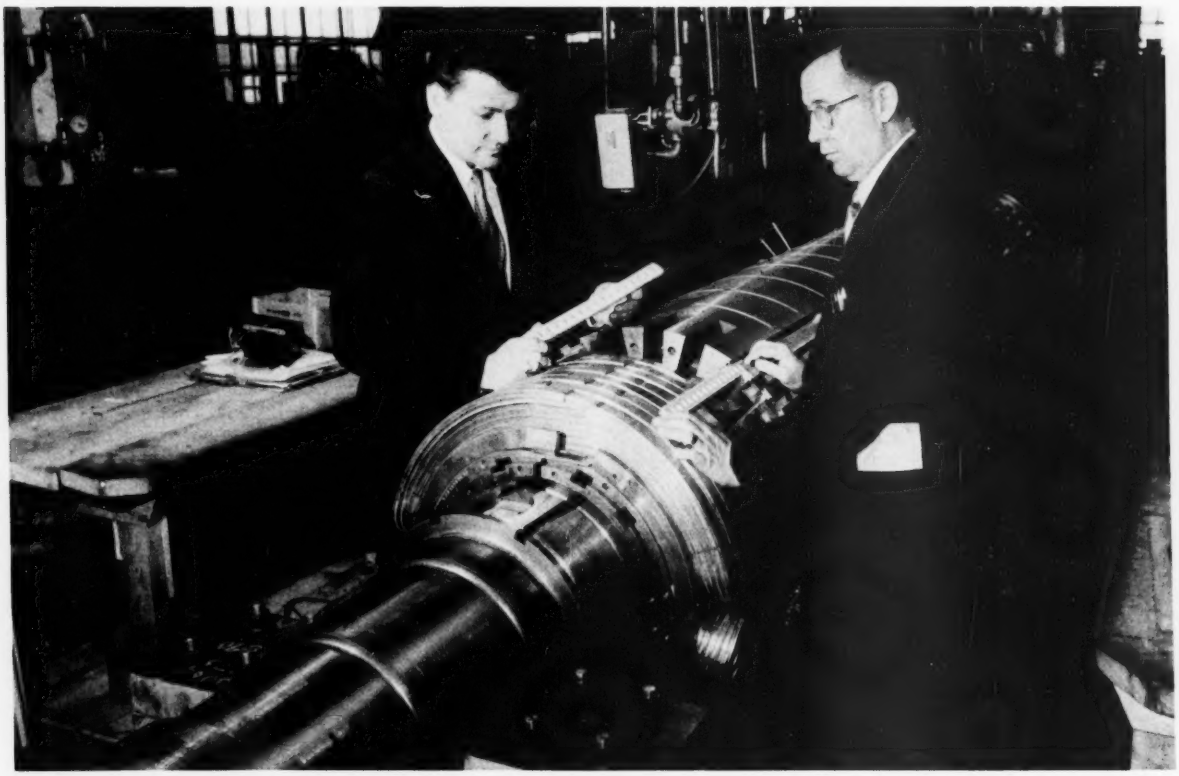
These blades, mounted on a larger diameter disc, produce a 25% increase in turbine capacity through increased steam-flow exhaust area. By using 3 sets of these blades, a 250,000-kw turbine generator is being built on a single shaft. Such construction saves over 600 tons of metal alone! In addition, smaller cranes and lighter foundations are required. The end result—important reductions in cost per kilowatt.

Paralleling this advance in blade design, the development of inner-cooled generators has contributed equally to this increase in 3,600-rpm turbine-generator unit rating. The consistent Westinghouse standard of high quality in every component assures continuing protection to your capital investment.

Perhaps your long-term generation investment needs a careful analysis. Start by calling your Westinghouse Representative, he's backed by a wealth of engineering and technical assistance . . . all of which is available to you.

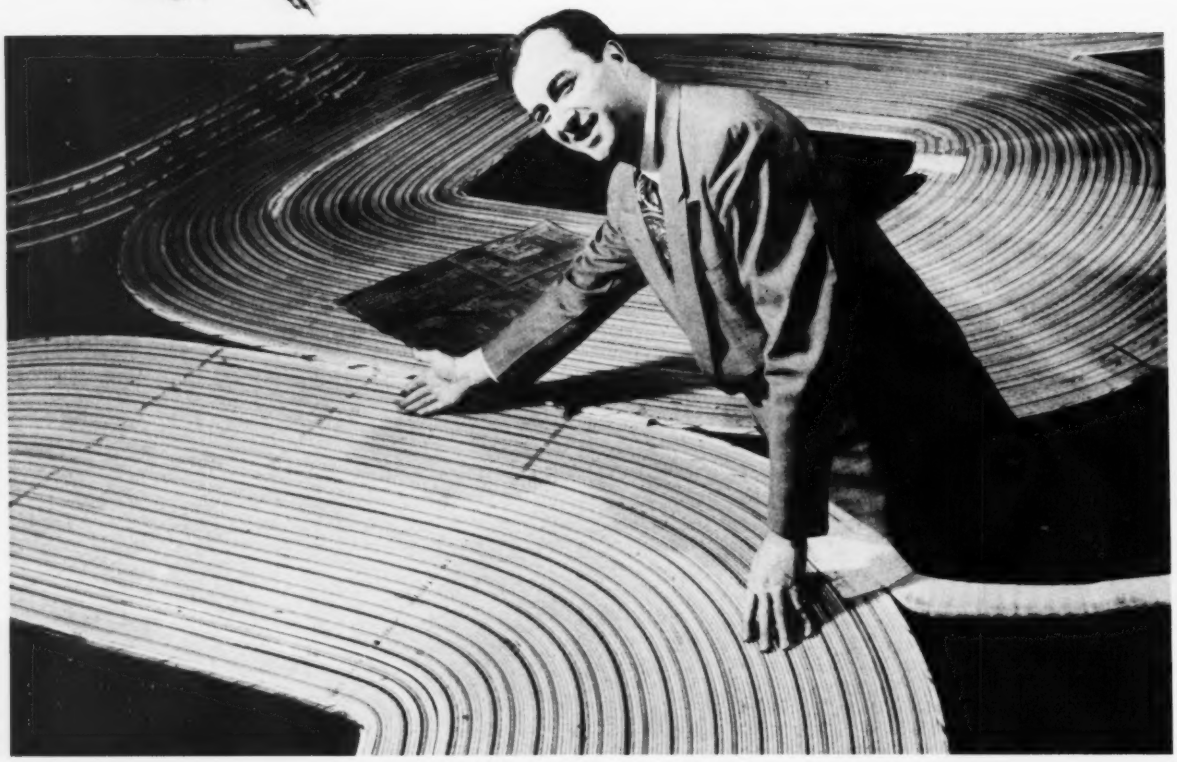
J-50551

Westinghouse Inner-Cooled Generator Design places coolant in contact with materials in which heat is generated. Here, engineers examine end turns of rotor for new inner-cooled, 100,000-kw generator now under construction.



Westinghouse

"John Cross of the Transformer Division says quality starts with basic design in large power transformers."*



Inherent protection of Westinghouse Transformers is based on simple physics

$s = \frac{P}{A}$ This simple unit stress formula expresses a fundamental in power transformer design: the greater the surface area, the smaller the psi force. By utilizing this in coil sections like the one shown here, Westinghouse Form-Fit Transformers not only give you improved physical properties, but better electrical characteristics as well.

Here's how:

Greater short-circuit capacity. When the magnetic stress of short-circuit surges tends to push coil sections apart, the force is minimized to low psi value because of the wide area over which it is distributed. This results in inherent coil insulation protection by maintaining a compact structure.

High impulse strength. Broad surface areas produce high coil-to-coil and low coil-to-ground capacitance. Thus, initial distribution of surge voltages through the winding is excellent, reducing unit stress and the magnitude of subsequent oscillations.

Plus superior cooling. The pancake-type coils, standing in a vertical plane, form natural flues for rapid circulation on *both* sides of each coil, resulting in low-temperature gradients. This provides a greater cooling margin for overloads. Form-Fit construction is ideal, too, for forced-oil cooling. Since directed oil flow is inherent in the design, no baffles or other artificial devices need be introduced.

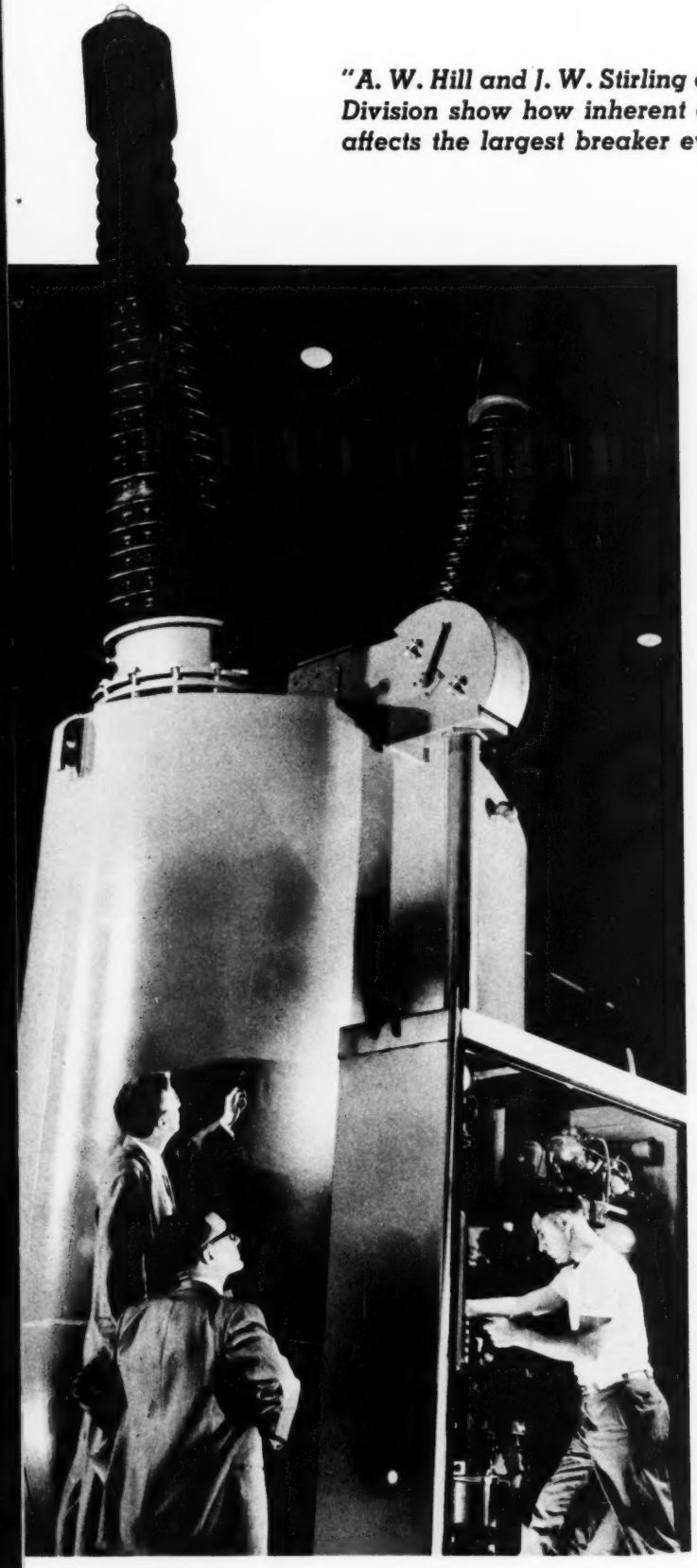
Important as these advantages are, they cover only part of the reasons why you can expect better protection for your capital investment with Westinghouse Power Transformers. Ask your Westinghouse Representative for further details, or write for Booklet B-4142A.

J-70686

*Manager, Power Equipment Section

YOU CAN BE **SURE**...IF IT'S

"A. W. Hill and J. W. Stirling of the Switchgear Division show how inherent quality affects the largest breaker ever built."



Interrupts 25 million kva . . .

basic Westinghouse Breaker design made it possible

This is "Big Ben", the world's largest circuit breaker. It can interrupt 25 million kva on a 330-kv system.

"Big Ben" has the *same* basic quality features available to you on all Westinghouse Power Breakers. The 25,000,000-kva arcs will be extinguished in famous Westinghouse "De-ion®" grids. Self-generated oil flow interrupts medium and high currents and mechanically pumped oil interrupts load and charging currents . . . all in three cycles.

Note that "Big Ben" is of the "Watchcase" design, now standard on large Westinghouse Power Breakers. This cuts the oil requirements in *half*. Watchcase design was made possible because Westinghouse De-ion grids limit the tank pressure to low values, eliminating need for the conventional larger volume, round tanks.

Like other Westinghouse Power Breakers, "Big Ben's" operating mechanism has a very important advantage: it is mechanically trip free. The contacts will open instantly whether or not there is pressure in the cylinder. Another important factor is simplicity of the operating mechanism—for example, latch adjustment has been eliminated entirely.

The bushings in "Big Ben" would be undesirably larger were it not for the Westinghouse condenser principle which provides high insulation value in smaller space. Radio interference is *nonexistent*.

"Big Ben" and the other power breakers Westinghouse builds are the result of 28 years of High Power Laboratory testing and development, the value of which has been proved by thousands of breakers in service—experience that cannot be duplicated. Write us now for more information on power breakers. J-60819

Westinghouse

"J. T. Thompson, Manager of Switchgear Assemblies, believes it takes all of these factors to really protect your investment."

YOU CAN BE **SURE**...IF IT'S

In Westinghouse Switchgear . . . ceramic-lined chutes tame arcs . . . protective treatments combat corrosion

Metal-Clad Switchgear is under constant attack—inside and out. An arc might be compared to a small electric furnace—blasting at the chutes and contacts. So Westinghouse lines arc chutes with a true ceramic material containing a high percentage of *zircon*. Zircon has the highest melting point of any known material. Westinghouse Arc Chutes will not absorb moisture. They have high dielectric properties comparable to porcelain.

This switchgear employs the most effective method of arc extinction in use today. Extinction takes place in split seconds and the arc is on the main contacts for only a fraction of this time. Result . . . less contact burning, less chute wear, less shock to the whole unit.

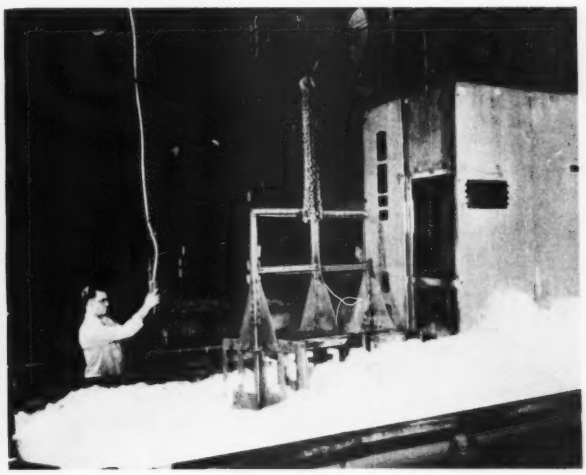
The best practical surface protection we know of is Bonderizing. We Bonderize our metal enclosures *after* they're assembled so that every nook and cranny gets the full five-dip treatment. Then the enclosures are painted twice, and the paint sticks as though it were part of the metal.

There's no worry about corrosion on the hard-to-get-at undersurfaces of Westinghouse Outdoor Switchgear. After assembly, we spray on a heavy layer of rubberized coating.

Westinghouse Switchgear was born in the famous High Power Laboratory. Working tests in the Laboratory duplicate actual operating conditions. You're sure Westinghouse Switchgear will perform as expected.

Our Booklet B-5306 tells more about the "extras" in Westinghouse Switchgear. Write for your copy. And better still, if you're near Pittsburgh, let us take you through the East Pittsburgh works. We would like to show you how we build equipment that is the soundest investment for your switchgear dollar. J-60820

Hard-to-get-at undersurfaces of outdoor switchgear are coated with a corrosion-stopping compound.



To prevent corrosion, the entire metal enclosure gets a five-dip Bonderizing treatment and two coats of paint.

Westinghouse

"Here's how the High Power Laboratory helped make modern breakers possible."

Before Westinghouse built the High Power Laboratory, testing was done the hard way. Early field test setups showed the real need for an all-weather testing location with 24-hour availability. In 1925, forward-thinking management approved construction of . . .

A Laboratory where arcs and short-circuit kva are the standard ingredients . . . poured into test equipment day after day, under controlled conditions. The result . . . outstanding contributions to breaker development such as . . .

The Multi-Flow Grid—which cut breaker times from eight to three cycles and permitted up to 50% reduction in tank sizes. Thanks to continuous tests, Westinghouse has been able to increase Multi-Flow Grid ratings to 25,000 mva at 330 kv. Another landmark in breaker design is . . . the "Watchcase" tank—which reduces oil requirements an additional 50%.

The cumulative experience and test data of the High Power Laboratory are tremendous . . . they will have everlasting influence on switchgear design.

For more details on the Laboratory, "Big Ben" or other subjects discussed on the preceding pages—call your Westinghouse Representative. Or—write direct to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. CP-1003

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Emergency Installation

(*Continued from page* 194)

CHEFS stand by electric food warming equipment installed temporarily for special luncheon.

built for previous company use and was insulated with glass wool. It was designed for installation of heating units in a water filled section (150-gal capacity) above which were placed 2,100 lb of roast beef, 15 gal of peas, and 20 gal of potatoes. The main marie, operated manually, itself weighed 1,430 lb.

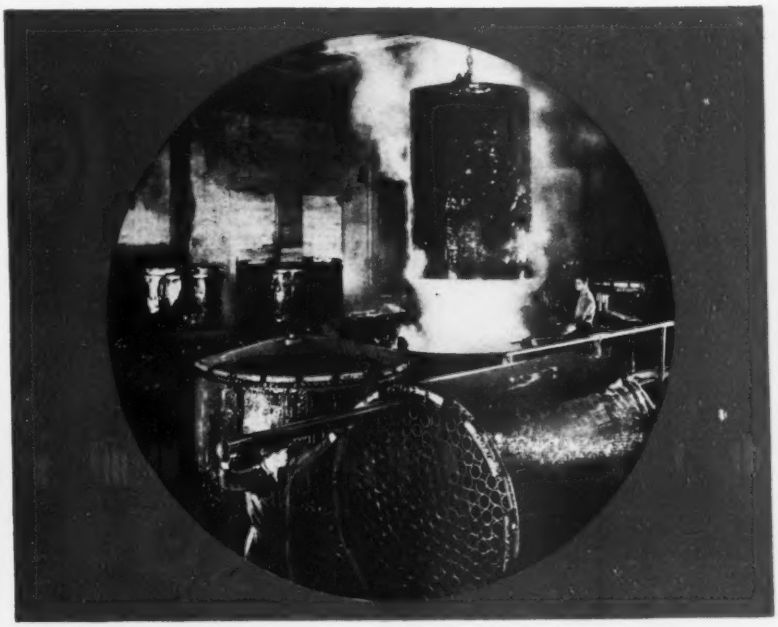
A commercial 3-ft griddle rated at 6 kw was used to keep gravy simmering in two 10-gal milk cans, and a 5-kw, 80-gal electric water heater maintained proper heat for the coffee. The coffee was poured into the heater from a stand and ladder, and stored there until served.

Including a test run the day before the luncheon, the equipment consumed about 250 kwhr. It took a day to remove the equipment.

Westinghouse Launches All-Out Appliance Drive

With the introduction of three new appliances — a range, automatic washer, and electric clothes dryer— Westinghouse Electric Corp's Electric Appliance Division has launched a multi-million dollar fall sales drive for its major appliance retailers.

The campaign got under way with announcement of the company's second "Blessed Event" promotion. To parents of twins born on Sept. 23, Westinghouse will present a free laundromat and clothes dryer.



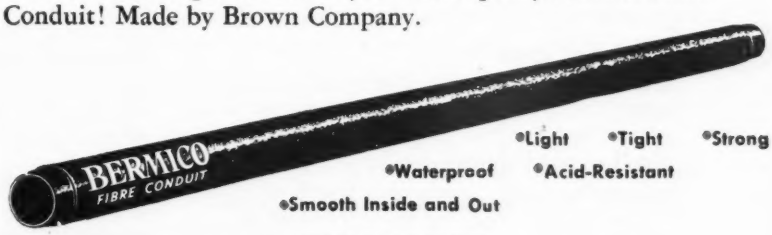
"Blending"

BERMICO® FIBRE CONDUIT

. . . for perfect uniformity Here, in the impregnation phase of Bermico's production, wood fibre and coal tar pitch become as *one* substance. Under vacuum, sturdy wood fibre tubes are thoroughly infused with tough preservative. The result is Bermico Fibre Conduit—*completely uniform* from end to end!

Bermico's uniform impregnation is matched by: *uniform wall thickness . . . uniform diameter of bore . . . uniform quality of fibre.* This pattern of uniformity is the result of production that features automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections.

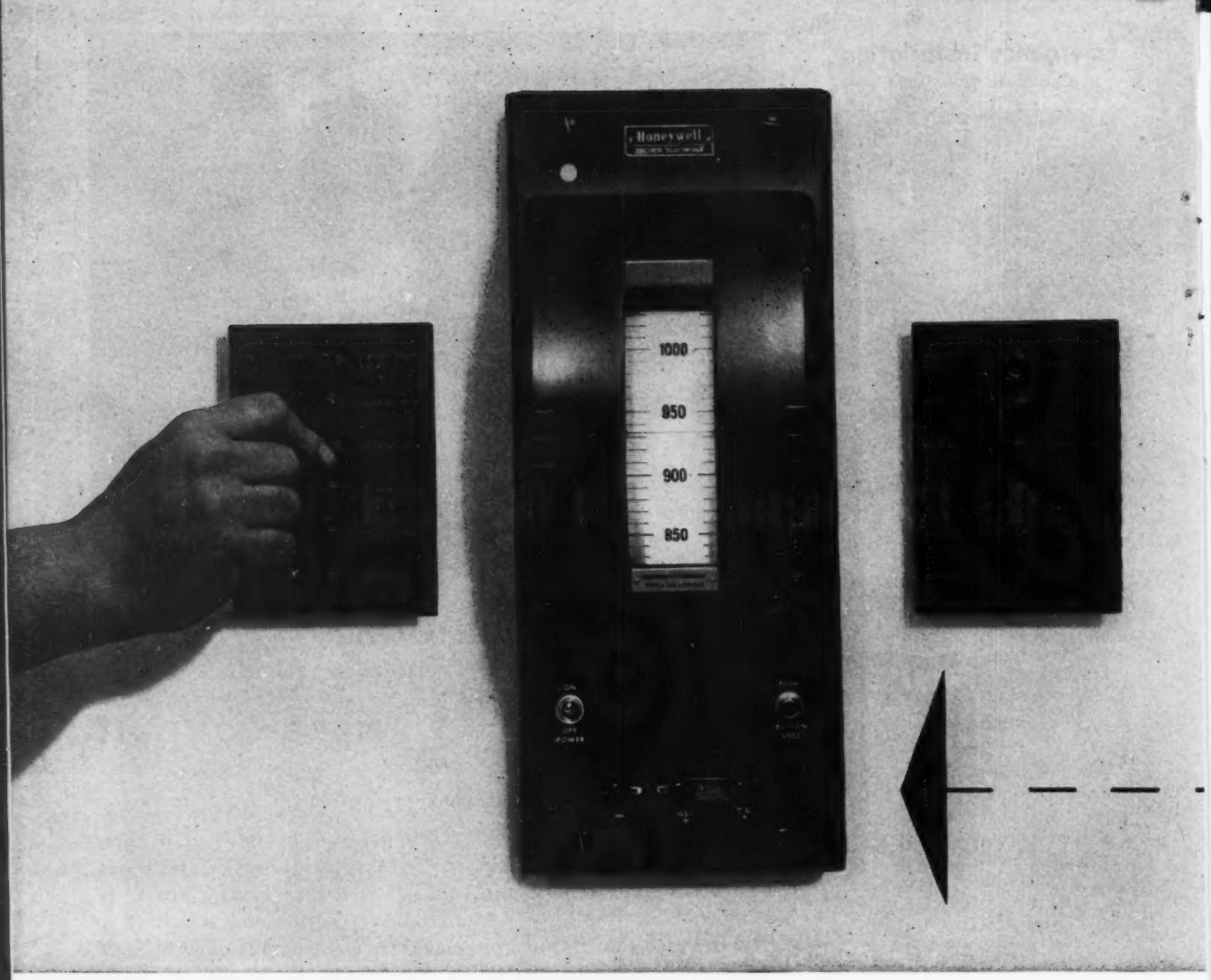
For the best protection for your cable specify Bermico Fibre Conduit! Made by Brown Company.



Distributed by **WESTINGHOUSE** Electric Supply Company.
Offices in principal cities

BROWN COMPANY, Berlin, New Hampshire
CORPORATION, La Tuque, Quebec

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS



Look at these features!

compact case
approximately 6½ inches wide by 15⅜ inches high

easily-read drum scale
rotates vertically; graduated length 28⅝ inches provides big, legible scale divisions and numerals.

accurate hairline index
eliminates parallax errors, permits high readability.

fast measurement
full scale rotation in 4½ or 12 seconds for 60-cycle operation.

external key switches
can be located at the side of the indicator (as shown), below or above—wherever most convenient for the particular panel layout.

large number of points
additional key switch banks provide any desired number of temperature points. Legend plates facilitate identification.

high precision
calibrated accuracy is 0.2% of scale span.

variety of ranges
supplied for use with either thermocouples or resistance thermometers, in a selection of ranges applicable to power plant temperatures.

Squeezed for panel space?

THIS NEW

Honeywell temperature indicator

needs no elbow room!

CROWDED PANELS are no problem for this new temperature instrument . . . the Vertical Scale Precision Indicator. Its slender, compact case makes it a natural for graphic panels—and a readily-inserted, space-saving member of conventional generator and turbine boards.

Basically, it's the same *ElectroniK* Precision Indicator which the power industry and many others have used and relied upon for many years. But, its outside appearance has changed: it's a completely new design that places the bulk of the instrument mechanism *behind* the panel . . . uses the valuable front-of-panel space primarily for the indicating scale.

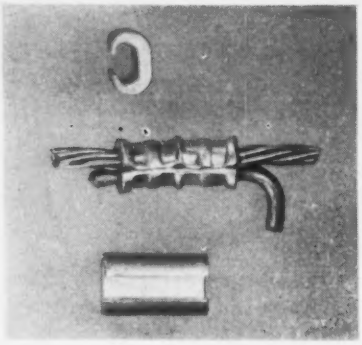
Equipped with key switch banks, the Vertical Scale Precision Indicator offers a fast, convenient way to spot-check temperatures in bearings, pumps, hydraulic couplings, motors and other potential hot spots.

Your local Honeywell engineering representative will be glad to discuss how this new instrument can save space on the new panels which you may be planning. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

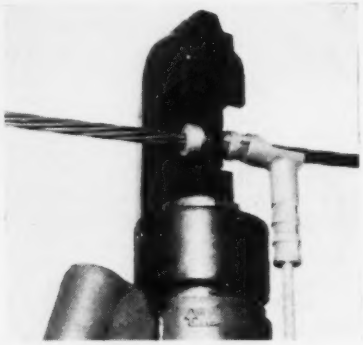
● **REFERENCE DATA: Write for new Bulletin No. 1541 on the Vertical Scale Precision Indicator.**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

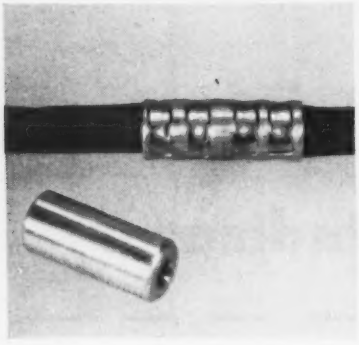


Crimpit

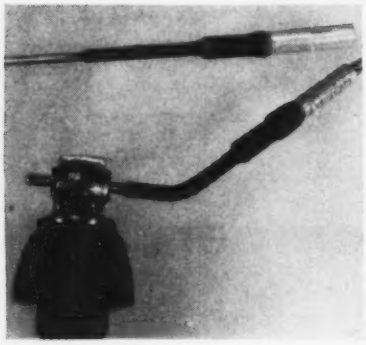
Crimpit Deadend



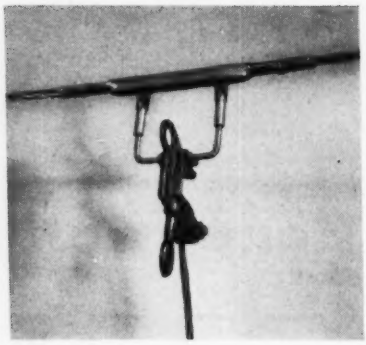
Eltap



Linkit



Bytap



Stirrup

Compression Connectors For Aluminum and Copper

A diversified line of six quickly-installed compression connectors with matched installation tooling has been developed. Connectors are designed to meet the majority of distribution connector requirements including connections of aluminum to copper, aluminum to aluminum, and copper to copper. Pressures of about 50,000 psi, applied by either of two tools, are said to establish permanent, stable connections that are subject to minimum corrosion when properly installed.

Crimpits are shaped in a figure "C", with heavy walled construction, to slip over conductors. They are made of aluminum for aluminum conductors and of copper for copper conductors in sizes through No. 4/0, for both copper and aluminum conductors.

Crimpit Deadends, made of aluminum or copper, are longer versions of the Crimpit, and designed for use on secondaries and service deadends. Their "C" shape facilitates installation on No. 6 through No. 2 aluminum, copper, or ACSR conductors.

Eltaps, made of aluminum, are designed for tap applications of copper, aluminum, ACSR, or any combination of these conductors. They are said to inhibit galvanic corrosion and are available to accommodate copper, aluminum, or ACSR conductor sizes No. 6 to No. 2.

Linkit tubular aluminum compression splices are for service entrance applications of either copper or aluminum or a combination of both. Filled with compound by manufacture, they are available in sizes No. 6 through No. 2 for copper, alumnium, or ACSR conductors.

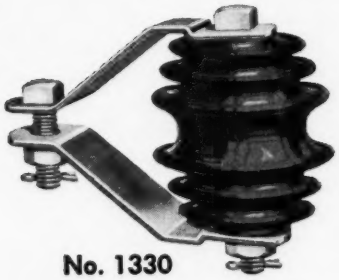
Bytaps for connecting aluminum to copper or copper alloys and aluminum to copper equipment taps are made of alumnium and copper. Factory bonded aluminum to copper joint is covered with a weather-resistant plastic, bonded to metallic surfaces, and said to inhibit galvanic corrosion. Compression elements will accommodate No. 6 through No. 2 aluminum or ACSR conductors.

Stirrups for hot-line tapping aluminum or ACSR runs to copper taps are made in a process similar to that required for the bytaps. They will accommodate No. 4 through No. 4/0 ACSR, and any standard copper Hot-tap.

Hypress is a hook-head hydraulic tool with five die sets for making compression connections on conductors through No. 4/0 copper, aluminum,

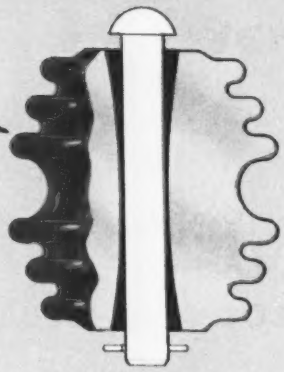
Better DESIGN

Gives Greater Strength

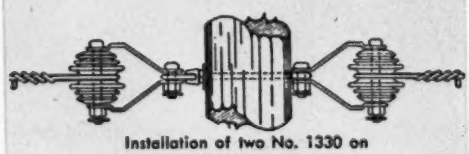


No. 1330

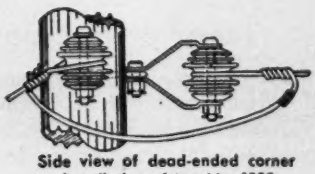
No. 1344



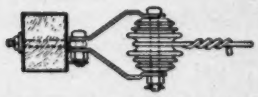
Cutaway view of No. 1613 Insulator showing the Insulator Bolt Hole Design slightly exaggerated.



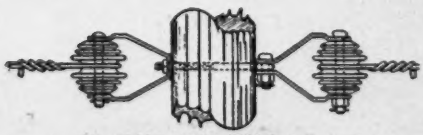
Installation of two No. 1330 on eye bolt and eye nut



Side view of dead-ended corner installation of two No. 1330



Typical cross arm installation of No. 1330



No. 1344 and No. 1330 installed on opposite ends of eye bolt

A mechanical feature of these Hubbard Clevises, not generally known, is the design of the bolt hole in the insulator, known as the "double tapered hole" as illustrated by the cut-away view above. Its purpose is to develop maximum strength in the porcelain. Most insulator failures, under heavy line load, start at the outer ends of the hole. This is due to the slight "bowing" of the bolt under loading, which results in concentrated "high point" pressures on the porcelain at the ends of the hole.

The "tapered" design, on the contrary, transfers the strain from the ends of the hole to the center portion of the insulator during the first stages of the loading. The center portion is stronger and presents a larger area, resulting in a lowered pressure. As the loading is increased, the bowing of the insulator bolt continues until it conforms to the taper of the hole, at which stage maximum resistance to the load is offered.

It is this design which has established these Hubbard Clevises as the high strength, quality products which they have been down through the years.

Electrically and mechanically . . . they are better.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

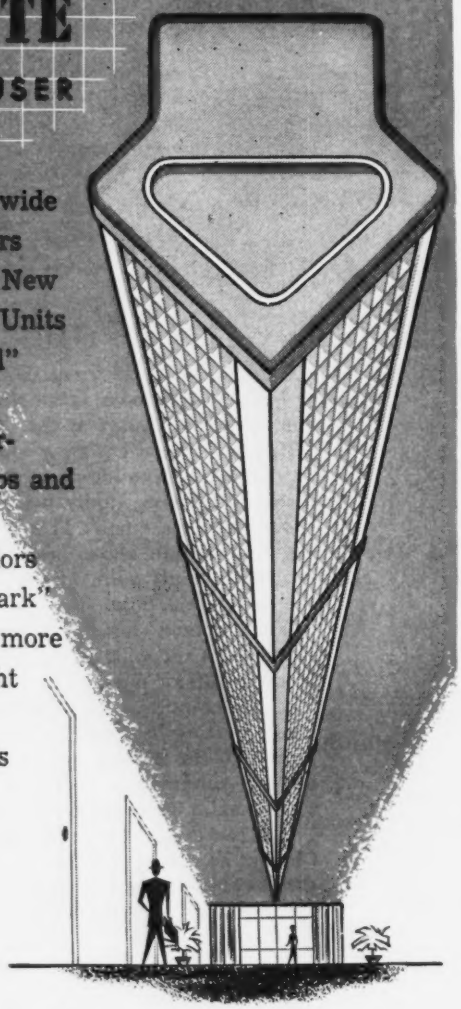
make hallways say, "Come in!"

new Guth V·C·U

"V" CORRIDOR UNIT

with GRATELITE* LOUVER-DIFFUSER

At last—you can fill wide hallways and corridors with practical light! New Guth "V" Corridor Units provide "wall-to-wall" illumination. The GRATELITE Louver-Diffuser shields lamps and is easily maintained. Hallways and corridors "come out of the dark" and turn into safer, more cheerful lines of light that guide the eyes and the step. V·C·U's available in 4′ & 8′, 1 & 2 light models.



*Patents Pending
Trademark Registered

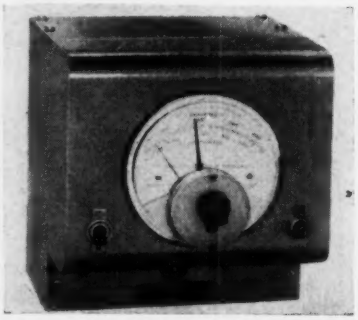
Write today on your letterhead for complete information.

Guth

THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.

and ACSR. Hook head makes it possible to slip the tool over connectors without removing dies. Hydraulic system permits use of multiple crimp dies. Overload valve controls tool and a release valve returns ram to open position. Hypress can be used with hot sticks. Cutting dies to remove connectors can be furnished with it.

Hytool, a mechanical hand-operated tool that is said to develop greater mechanical advantage than bolt cutters, has a compound jaw designed for connector sizes through No. 2 ACSR, stranded copper, and aluminum. It is adaptable to hot sticks and has insulated handles.
Burndy Engineering Co, Inc, Norwalk, Conn.



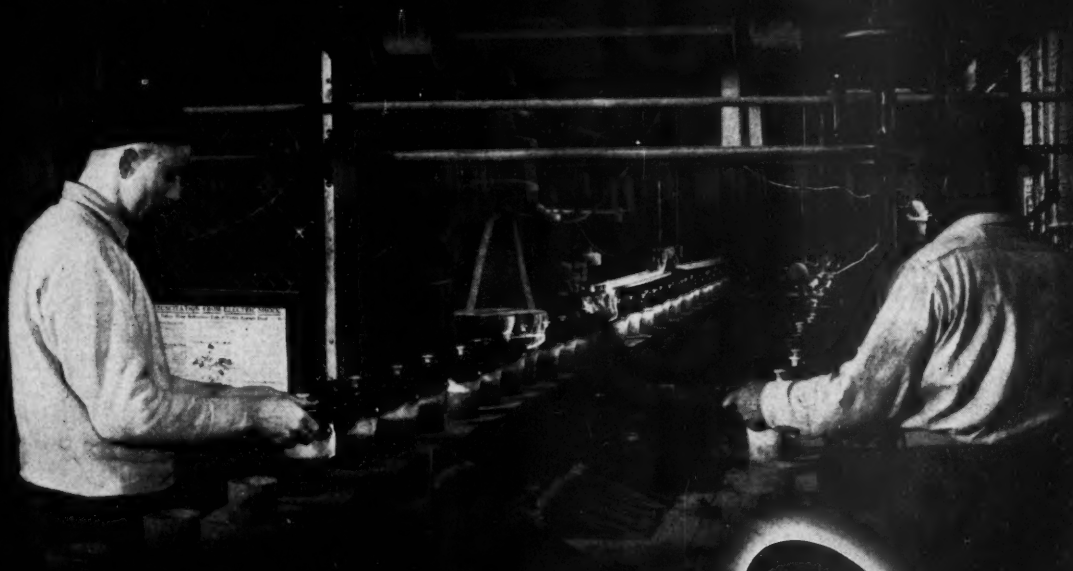
Temperature Control

A temperature controller used in conjunction with an electronic circuit has been announced. It is a combination cut-off and automatic hold type controller with thermocouple break protection. Exhaustive tests are said to show that the Model 505 is capable of maintaining temperature control to an accuracy of 2% of full scale range for over 1,000,000 continuous contact cycles.
Cybertronic Corp of America, Upland, Chester, Pa.

Control Cable

Designated SI-58134, the silicone-rubber insulated station control cable is said to maintain circuit integrity even in case of severe fire along the

VICTOR *PURIFIED PORCELAIN* SUSPENSIONS
RUN THE GAUNTLET TO GIVE YOU GREATER SERVICE



Victor No. 924 (25,000 lb.) Suspensions undergoing high frequency and 60-cycle flashover tests on Victor-designed continuous testing machine.

Every Victor Suspension Insulator has to "run the gauntlet" through the flashover testing machine illustrated here. And every one must stand up under both high-frequency and 60-cycle flashover for a period of more than three minutes before being eligible for shipment. This stringent, individual testing, coupled with the greater toughness, uniformity and resistance to impact of Victor *Purified Porcelain* gives greatest possible protection for your lines! More reasons why Victor is the power man's best buy! For full data on Victor Suspensions, write for Bulletin No. 4.

VICTOR NO. 924
(25,000 lb.)
SUSPENSION

FREE BOOKLET gives you the full story on how Victor insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

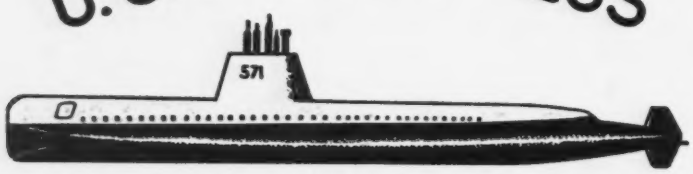
Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

.....another Shawmut first

Amp-traps*

For

U.S.S. NAUTILUS



FIRST NUCLEAR POWERED SUBMARINE

...How about letting Amp-traps stop dangerous short circuits for you?

In Canada — Powerlite Devices, LTD.

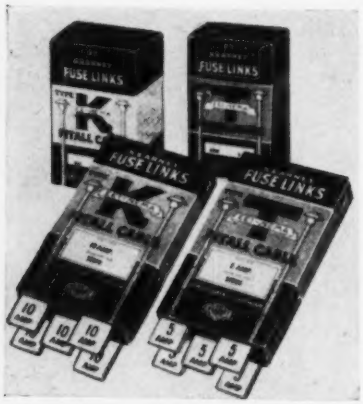
©The Chase-Shawmut Co. 1953 *Trade Mark

THE CHASE-SHAWMUT CO., NEWBURYPORT, MASSACHUSETTS

cable run. It is designed for control circuits in power stations, around boiler rooms, or in high-temperature processing operations.

Maximum ambient operating temperature for continuous operation is 257F. In laboratory tests, the cable is said to have withstood 1,400F flame for 24 hours. This is because silicone rubber burns to a non-conducting ash.

General Electric Co, Bridgeport 2, Conn.



Fuse Links

A line of preferred and non-preferred ratings of fuse links conforming to EEI-NEMA type K (fast) and type T (slow) standards has been announced. New links have features of the company's regular fuse-link line and are similar in construction.

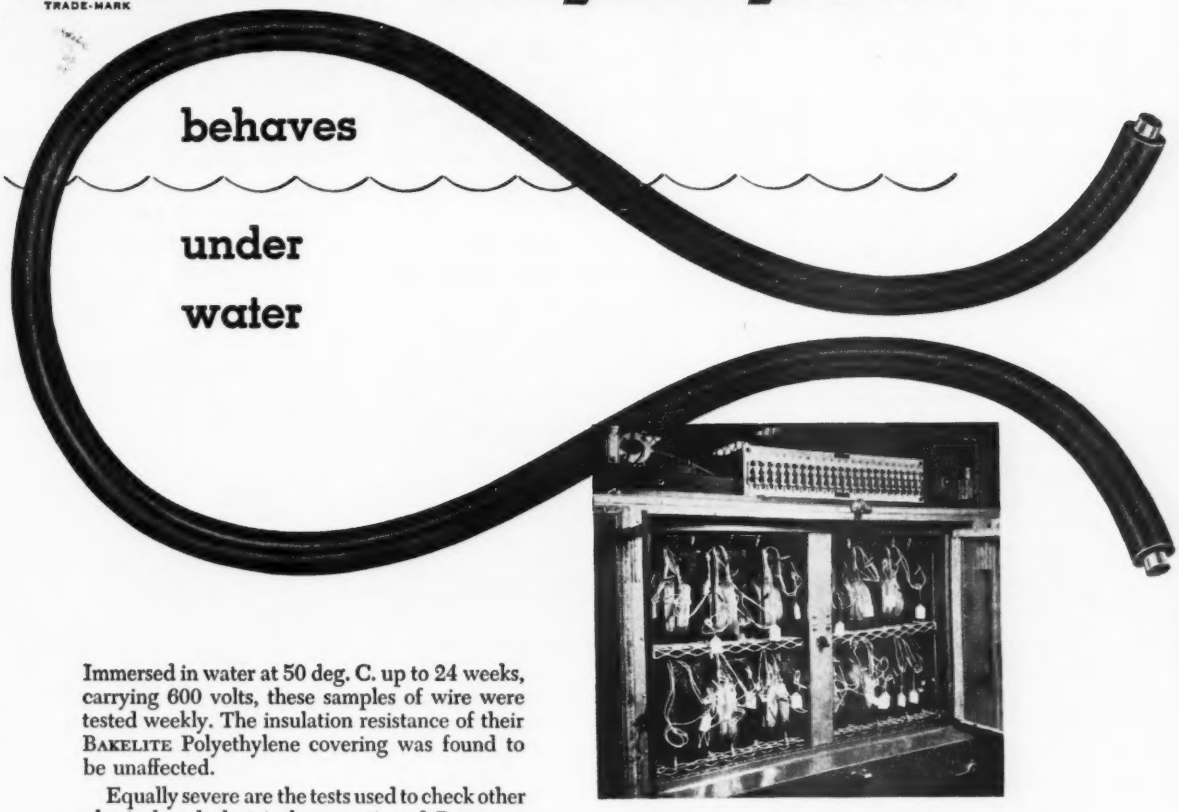
The button head is attached by screw threads. Cable can be supplied with a universal adaptor for use when button is removed. Ratings above 6 amp are constructed with tin elements for low operating temperatures. A protective tube, covering the current responsive element is used on all links up to and including 100 amp.

James R. Kearney Corp, St. Louis 10, Mo.

Degreasing Unit

A compact vapor degreasing unit is being produced that is capable of performing 200 lb of work per hour. The No. 100 CS has both a rinse and boiling sump along with a water jacketed vapor area. Distilled solvent is collected in a condensate return trough, passed through a water sepa-

How wire covering of BAKELITE TRADE-MARK Polyethylene behaves under water



Immersed in water at 50 deg. C. up to 24 weeks, carrying 600 volts, these samples of wire were tested weekly. The insulation resistance of their BAKELITE Polyethylene covering was found to be unaffected.

Equally severe are the tests used to check other physical and electrical properties of BAKELITE Polyethylene. This remarkable line wire covering withstands abrasion, weathering, and chemicals. The approved black compound resists deformation up to 90 deg. C., stays flexible at temperatures as low as —70 deg. C. It meets ASA suggested specifications (second draft: July 20, 1952) for weather-resistant wire and cable.

BAKELITE Polyethylene (black compound) has a specific gravity of only 0.94—lighter weight that means easier stringing. Its outstanding physical and electrical properties provide a thinner wire covering that speeds stripping and splicing. Its smooth waxlike finish helps in pulling over crossarms. Extruded over wire, a covering of BAKELITE Polyethylene *won't festoon.*

To learn about the properties of BAKELITE Polyethylene in detail, get your free copy of Kabelitems No. 48. Write Dept. QZ-63.

OUTSTANDING ELECTRICAL PROPERTIES (black compound) for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C., power factor is only 0.004; dielectric constant is 2.5. These values hold through the range from 60 cycles to 5 x 10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE Polyethylene excels in resistance to voltage breakdown, even after long-continued water immersion.

BAKELITE TRADE-MARK
Polyethylene
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.
In Canada: Bakelite Company (Canada) Ltd., Belleville, Ontario

GAI-TRONICS POWER PLANT COMMUNICATION SYSTEMS . . .

Prove that ENGINEERING and EXPERIENCE make the BIG difference!

CONSULTING

DESIGN AND ENGINEERING

FABRICATION

OPERATION

The *completely engineered* GAI-Tronics power plant communications system is designed and built by men associated with the design, construction, and operation of power plants throughout the world. Their "know-how" insures the solution to your power plant communication problems.

Two-way or group conversations can be carried on over telephone-type handsets and sound projectors *without* using special booths. The projectors can be used for paging and issuing emergency instructions. If you desire, telephone-like privacy may be had with the flick of a switch even though the system remains alerted for emergency use. The completely engineered GAI-Tronics system can be installed by *your* maintenance men. With a GAI-Tronics system, your power plant is equipped with a custom-designed, internal communication system that is easy to install; easy to operate; easy to maintain. A GAI-Tronics power plant communication specialist will be glad to discuss your communication problems.

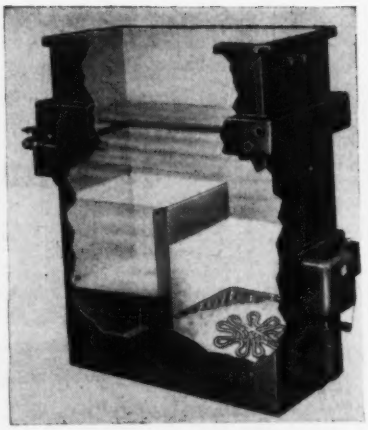
GAI-TRONICS
CORPORATION
READING, PA.

GAI FOUNDED 1906

A SUBSIDIARY OF GILBERT ASSOCIATES, INC.

FREE!

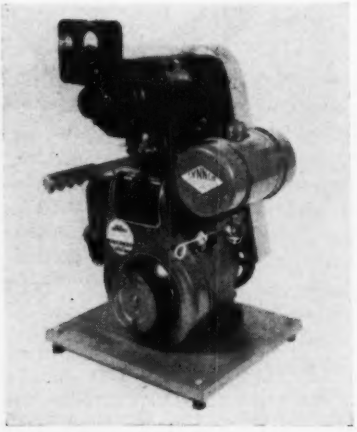
A booklet—Power Plant Communication Systems—or a convincing demonstration in your plant. The portable GAI-Tronics system designed by our engineers for this specific purpose can be scheduled for your plant upon request without obligation. Write today. Dept. G-T.



rator and returned to the rinse sump.

Boiling sump is fed by over flow from the rinse sump. The unit has a distillation rate of 7 gal per hour based on a 30% contamination of solvent. Three-kw heating units are available for 110 and 220 v single phase; and 220, 440, and 550 v 3 phase, all at 60 cps.

Phillips Manufacturing Co, Chicago 45, Ill.



Engine Generator

An engine-generator set has been announced that features mounting of the generator on vibration insulators above the engine. This is said to result in compactness, portability, and accessibility. Having a maximum output of 3 kw, the plant has a continuous rating of 2 kw, 115 v, single phase, 60 cps. It measures 18 x 20 x 29 in.

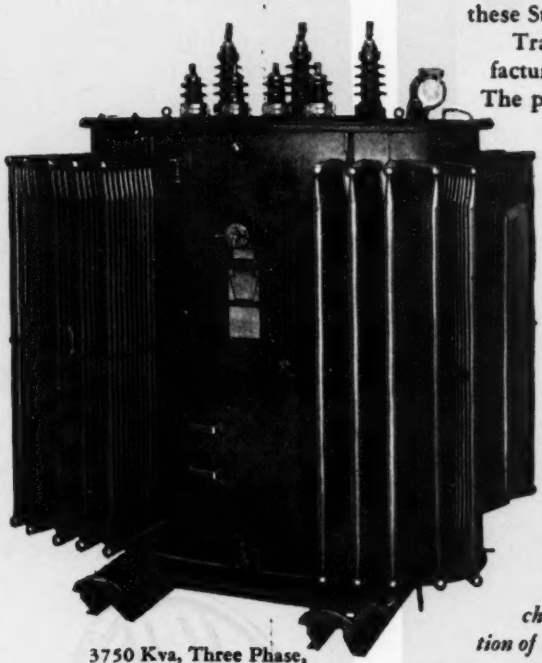
Other features include: A built-in voltmeter and control box with two twist-lock outlets, overload protection

(*Continued on page* 216)

PENNSYLVANIA
Standard Parts
POWER TRANSFORMERS
save YOU time and money . . .

this transformer saved the purchaser

$1196



3750 Kva, Three Phase, 60 Cycles.
34,400△-4360Y/2520x 8720Y/5040 volts.

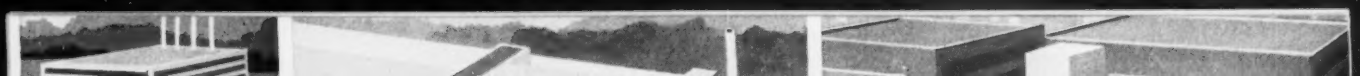
Here's another example of money saved and a quick delivery made on a 3750 Kva transformer that qualified as a Pennsylvania Standard Parts Power Transformer. Today, more than ever before, purchasers are recognizing the advantages of ordering transformers that conform to ASA Standards C57.12a. (Transformers covered by these Standards are similar to the Standard Parts Power Transformers that Pennsylvania has been manufacturing for 6 or 7 years.)

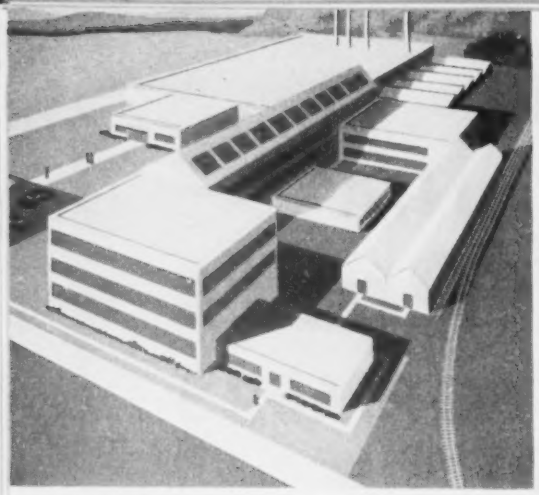
The primary advantage of Standard Parts Power Transformers is the fact that savings up to 8% are possible, even if requirements are not quite standard but are within the limits of the C57.12a Standards. That is because the Standard Parts transformer has liberalized high voltage ratings, which give the purchaser an opportunity to buy a standard transformer that meets the specific requirements of his System.

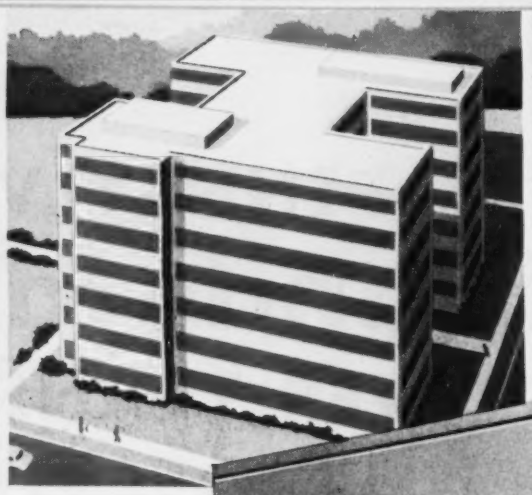
However, if the purchaser desires optional features such as current transformers, disconnect switches, etc., he may obtain them at regular prices and without any price penalty being added to the base price of the Standard Parts transformer.

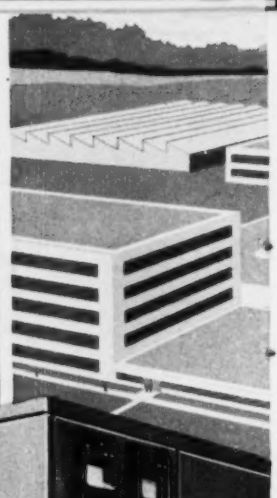
Standard Parts Power Transformers are available in single phase sizes up to 5,000 Kva, 69 Kv; and three phase sizes up to 10,000 Kva, 69 Kv. Standard Parts Power Transformers can be purchased at worthwhile savings because of quantity production of standard parts produced with adequate tools and equipment. This has improved the quality of the workmanship, reduced the possibility of errors, and permitted more rigid inspection during the various stages of production.

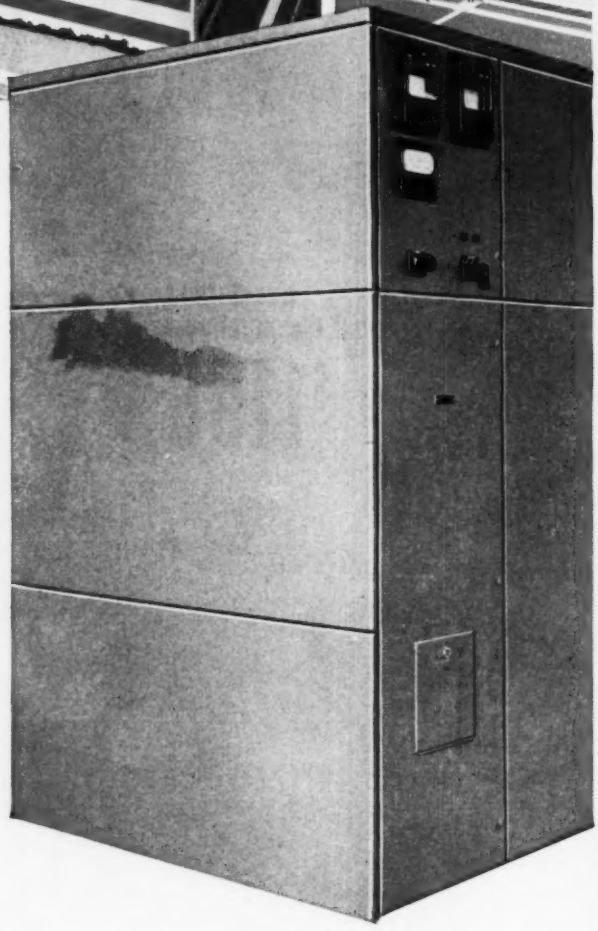
PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division • **Canonsburg, Pa.**







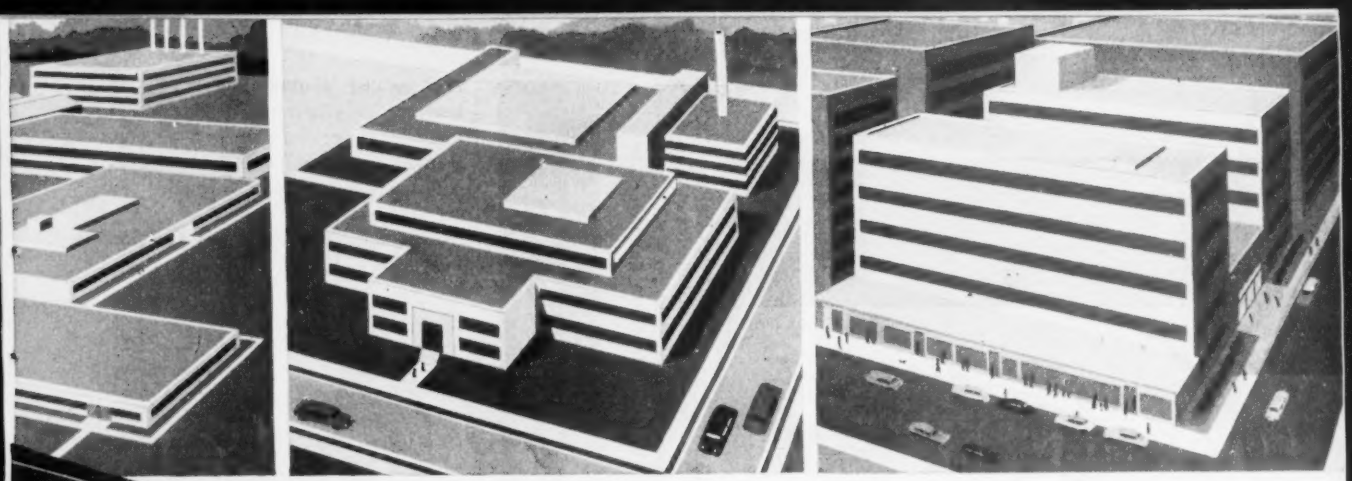


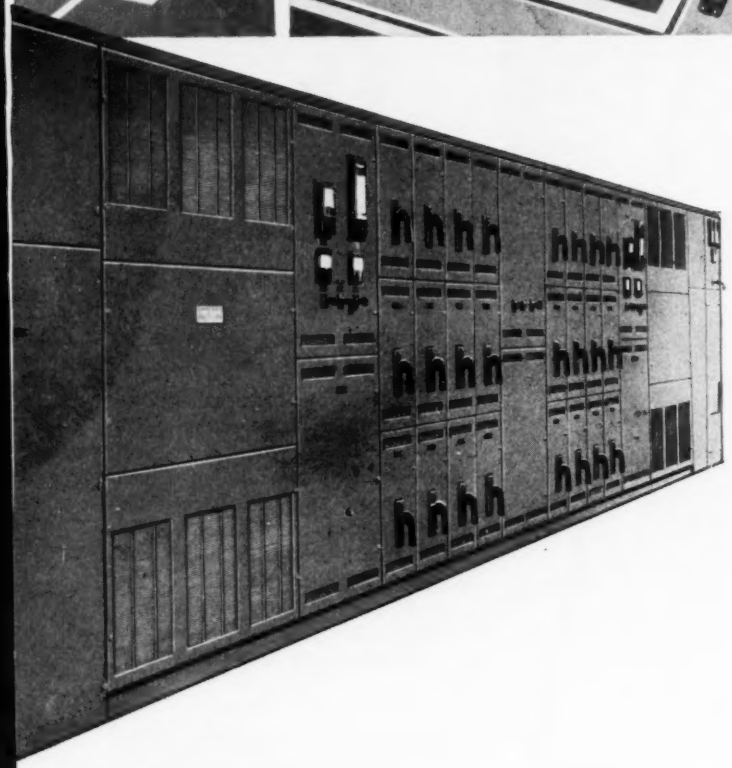


AS VITAL AS YOUR PLANT'S FOUNDATION

unit substations are basic plant investments

In central stations, industrial plants, or buildings—engineering management recognizes the need for power distribution equipment which is safe, dependable, economical, and adaptable. To Unit Substations, forming the *nerve centers* of any distribution system, is delegated the important responsibility of providing continuous power and circuit protection for years to come. Unit Substations, therefore, should not be merely *adequate*, but they must have quality to be a sound, *profitable* capital investment.





I-T-E offers a complete line of quality unit substation equipment

Through the years, I-T-E has led in the development and manufacture of quality circuit breakers and switchgear. Similarly, since the inception of the Unit Substation, and its use in modern distribution systems, I-T-E has continued to hold this same envied position. Today, I-T-E supplies a full line of quality Unit Substations, in types and sizes to fit every application.

As an *extra service*—to help users make the wisest investment possible—I-T-E furnishes engineering assistance in the selection and application of equipment, preparation of specifications, and coordination of all job requirements. There are I-T-E Application Engineers in every major industrial area for this purpose.

To find the I-T-E field office nearest you, look in the classified section of your telephone directory under "Electrical Equipment."

I-T-E Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia 30, Pa.

UNIT SUBSTATIONS

A GROWING NEBRASKA DEPENDS ON ELECTRIC POWER!

and . . . Control Corporation plays an important part!

WESTERN NEBRASKA is the heart of the state's great wheat and cattle country! From this part of Nebraska, to the great, mid-west cattle and grain markets flow shipments of cattle and grain to help feed the nation.

Western Nebraskans have been quick to realize the benefits of the state's low-cost electric power supply in developing the resources of this area. These alert people use electricity, wherever possible, to speed production, cut costs and increase the standard of living in their homes and communities.

Consumers Public Power District, a state-wide utility serving over 350 Nebraska communities, has selected Control Corporation equipment to serve in its key Chadron Power Plant in Western Nebraska.

Utility Bulletin AA-2 shows how supervisory control, telemetering and communication can fit into your power picture. Write for it.

Above photo shows switches at Consumers Public Power District's North Chadron Substation in Western Nebraska.

CONTROL CORPORATION'S Super-Trol installation at Consumer's Chadron Power Plant providing remote control of switches at its North Chadron Substation.

CONTROL CORPORATION
719 CENTRAL AVE. N. E. • MINNEAPOLIS 14, MINN.
• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current •

fuse, sealed lifetime lubricated ball bearings in generator, tapered roller main bearings in the 6-hp engine, manual governor control, automatic choke, impulse coupled magneto, and carrying handles.

Lynn Engineering & Supply Co, San Francisco 4, Calif.

Cutting Pliers

A cushion throat has been added to Utica diagonal or side cutting pliers to hold the short wire end during and after cutting, thus adding safety and convenience to the tools. The cushion is tough, rubbery red Plastisol, bonded in the throat beside the pliers' cutting edges. As the pliers close, the cushions grip the short end of wire tightly, holding as the cut is made.

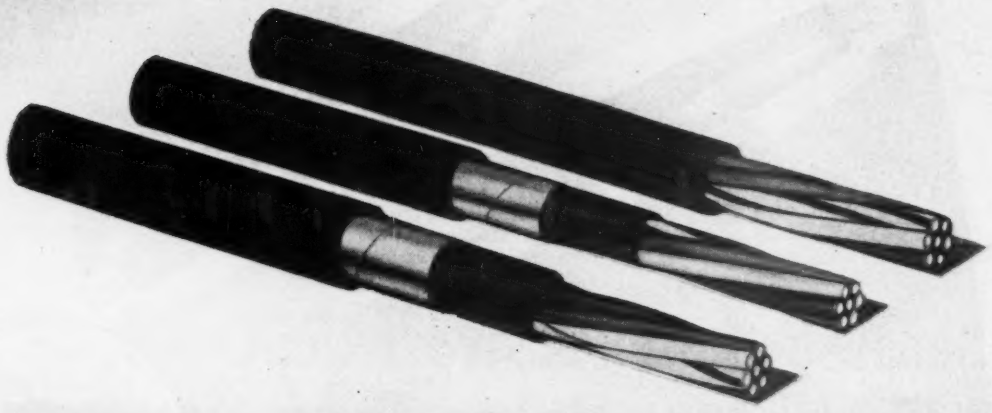
Utica Drop Forge & Tool Corp, Utica, N. Y.

Copying Camera

A new and fast copying camera with automatically controlled exposure speed and lighting has been designed to copy drawings up to 17 x 22 in. on to an 8½ x 13-in. plate. Paper masters are made from the plate by running off multiple copies on an offset duplicator.

The following specifications are

Make Your Terminations



in Half the Time!

Now you can terminate your signal and communication cables in half the usual time. Here's how. Install Simplex Polyethylene-Plastex Signal Cables.

Simplex Polyethylene-Plastex Signal Cables have no fibrous coverings that need to be trimmed back to prevent wicking. Terminating cables with fibrous coverings is slow, laborious and time-consuming. With Simplex Polyethylene-Plastex Signal Cables it's a snap.

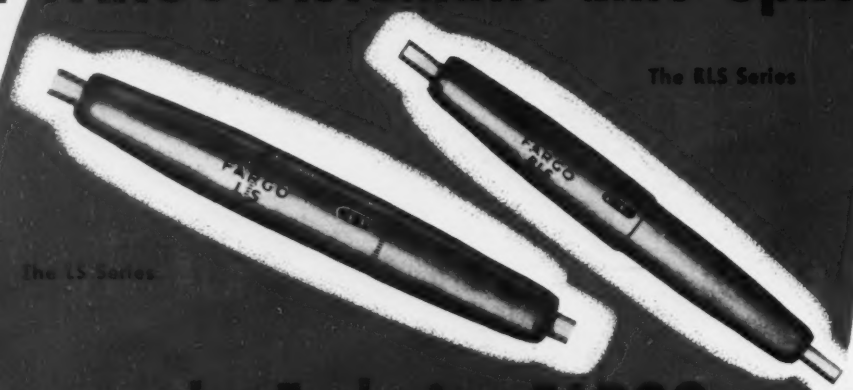
Simplex Polyethylene-Plastex Signal Cables do not need braids or other fibrous coverings to protect the conductors from light-checking or to provide color coding of the conductors.

● *For more complete information, contact your nearest Simplex representative or write for our newly-revised Simplex Polyethylene-Plastex Signal Cable catalog No. 1010, at the address below.*

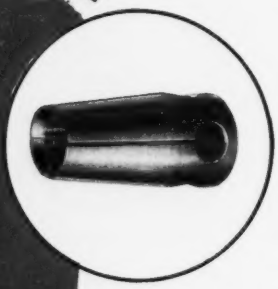
Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

You can be sure with FARGO Automatic Line Splices



. . . because the Exclusive FARGO "One-Piece" Jaw Makes Them "the sure splice!"



Many are the reasons why Fargo Automatic Line Splices are rated "the sure splice". In the first place, there's the greater strength and permanence provided by the self-aligned . . . exclusive Fargo "One-Piece" Jaw. The depth of the "bite" on the conductor—resulting from the accurately machined teeth of the jaw — assures full holding power, even after long exposure to corrosive atmospheres. They're easily and quickly installed . . . save Linemen's time — and ease the work of the entire crew. And, thanks again to the "One-Piece" Jaw—there's no need to use tools, because they're fully automatic. They're safer . . . lower in overall cost — and attested by wide and trouble-free use.

The *LS SERIES* is the standard, reclaimable type splice, available in sizes from 8 strand through 500 MCM; the *RLS SERIES* is a reducing splice available in all commonly used conductor combinations.

ALUMINUM SPLICES

The same design features used in the copper automatic splices are incorporated in the aluminum automatic splices for all aluminum conductors up to 397,500 CM.

Ask your Line Material Field Engineer to give you complete details.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

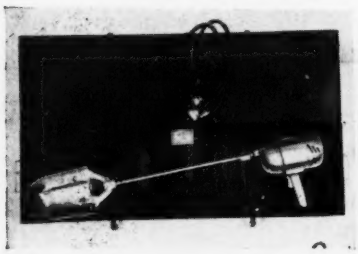
LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

LM®

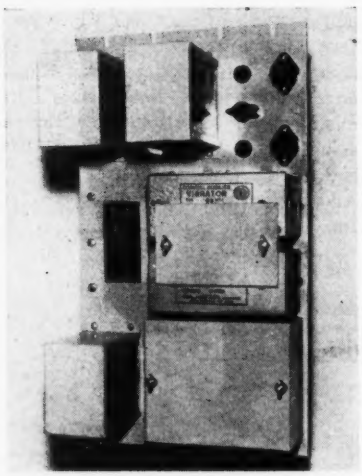
given for the XeroX Lith-Master camera: Overall length with copy board down 73 in., width 58 in., four 300-w reflector lights that are on only when the shutter is open, electrical timer with range of 0 to 60 sec, and electrically operated shutter.
Haloid Co, Rochester, N. Y.



Hole Digger

A new portable hole digger has been introduced for digging holes from 4 to 8 in. in diameter, up to 6 ft deep with a shaft extension. Boring head and shaft are of forged, cast, and machined parts of tough alloy steels.

Power required for operation is 1.25 kw, 115 v, ac or dc, 60 cps or less. A carrying case is available for the Super Hole-A-Matic.
Eugene John Freeman & Co, Van Nuys, Calif.



Vibrator Converter

A new vibrator converter for telephone, carrier, microwave, and standby duty has been introduced that is said to deliver continuous-duty power up to 350 w at 115 v, 60 cps, from an input of 48 v dc. The Model 3494 is able to pick up full load at approxi-

- Conductor doesn't have to be centered for accuracy, (toroidal wound transformer)
- Pocket-size, belt-mounting
- Covers 9 ranges
- Probe jaws completely insulated
- Test lead plug insulates itself when removed from meter
- No-rim window floods scale with light

only
AMPROBE
has these features!

AMPROBE "600"
0-15/30/60/150/300/600 amps A-C
0-150/300/600 volts A-C
$59.50 complete with cowhide case and voltage test leads.

AMPROBE "1200"
to 1200 amps A-C
$67.50 complete

AMPROBE "300"
to 300 amps A-C
$49.50 complete.

Measures current instantly without interrupting service

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(Export Div.: 458 Broadway, N. Y. Dept. EW-93
Cable: Morhanex)

AMPROBE®
the only pocket-size snap-around volt-ammeter

NEW!
AMPROBE Junior
VOLT-AMP TESTER

19.85 INCLUDING VOLTAGE TEST LEADS

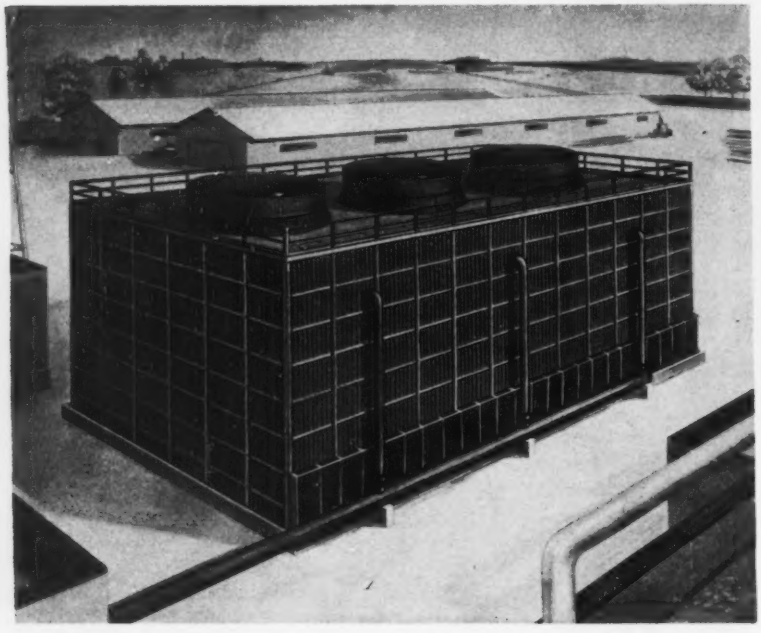
PICK THE RANGE THAT FITS THE JOB:
Model "10": 0-10 amps AC. 0-125/250 volts AC.
Model "25": 0-25 amps AC. 0-125/250 volts AC.
Model "50": 0-50 amps AC. 0-125/250 volts AC.
Model "100": 0-100 amps AC. 0-125/250 volts AC.
Write for Catalog No. 132

(Advertisement)

INDUSTRY NEWS IN BRIEF

SANTA FE'S NEW "MD-54" COOLING TOWER CUTS INITIAL COSTS, INCREASES PERFORMANCE

Los Angeles . . . Cooling tower *design* has undergone a number of significant improvements. After holding faithfully to the basic pattern, the Santa Fe Tank & Tower Company, Los Angeles, has taken an aggressive step toward developing a cooling tower with a substantially improved construction design. The newly designed tower is said to require fewer parts for construction, which in turn, allows for faster erection and less maintenance.



Santa Fe engineers branded their new tower the "MD-54" which is the result of a series of laboratory and field tests that measured all *performance* factors in relation to its new structural features. *Simplified* construction and better utilization of materials in the "MD-54" is the *key* to the new design and improved performance.

Santa Fe engineers have designed for the "MD-54" two separate and distinct standard types of wetted surfaces. After a series of extensive tests, it was found that one surface is best suited to lowest first cost, and the other surface to the lowest evaluated cost on an amortized basis. This makes the "MD-54" the most adaptable to meet the requirements of each individual plant.

According to Santa Fe, the basic design of the "MD-54" cooling tower allows for the largest possible range of size variations.

A new bracing system designed for minimum obstruction to the free flow of air results in better cooling performance. This new bracing requires only two specially designed joint connectors in conjunction with 3 standard braces to build any size or combination of sizes, shapes of the "MD-54" cooling tower.

Santa Fe Tank & Tower Co., 5401 So. Boyle Ave., Los Angeles 58, California

mately 50 milliseconds after the start relay is energized. Advantages of the convertor include:

1. Dependable operation over a wide range of input voltages.

2. Control of output voltage to a variation of about ⅓ of the input voltage variation.

3. Relatively constant output voltage as the load is varied.

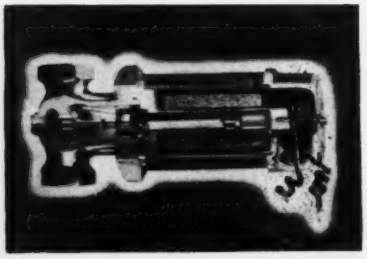
4. High overall efficiency.

5. Essentially sinusoidal output wave form.

6. An output frequency very close to 60 cps and not affected by the amount of load.

7. Dual vibrator circuits with automatic changeover within 3 sec if the service vibrator fails.

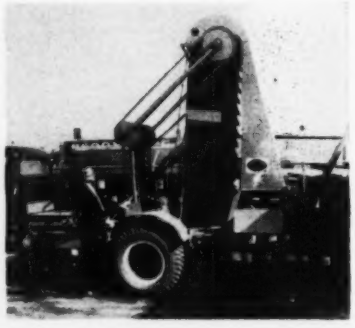
Cornell-Dubilier Electric Corp. South Plainfield, N. J.



Steam Valve

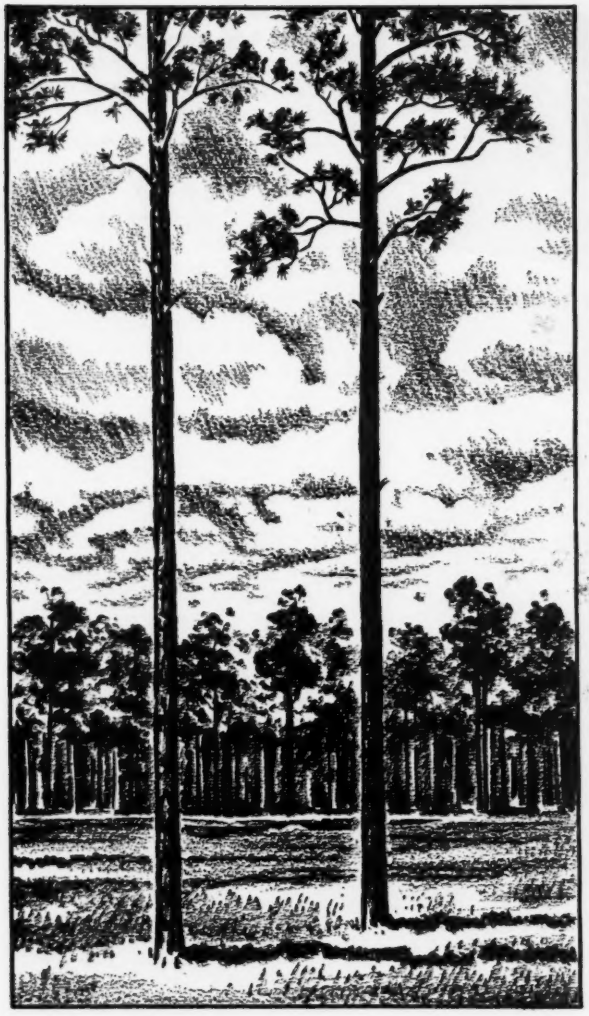
A steam valve has been announced that is said to be engineered to prevent sticking caused by expansion combined with deposits of iron oxide, boiler compound, lime, etc. The manufacturer reports the new design assures high valve efficiency, long life and low maintenance costs.

Atkomatic Valve Co, Indianapolis 25, Ind.

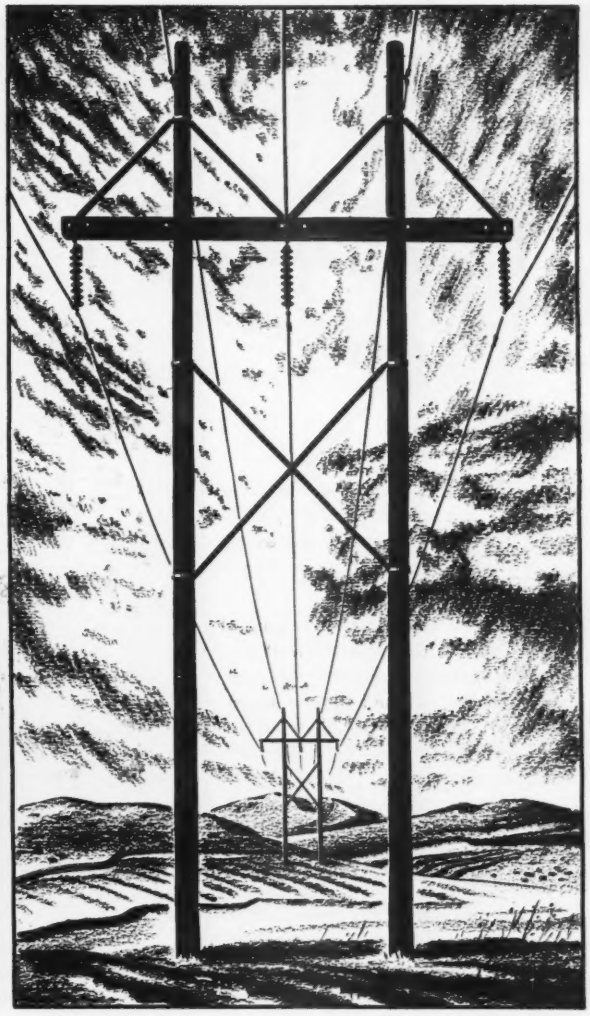


Ditching Machine

A new truck-mounted ditching machine featuring a jack-knife boom



These trees required over 100 years to grow to usable size. It takes a great deal of labor and expense to transform them from living trees to poles. The growth years and the labor expenditures represented constitute a very considerable investment deserving the best in preservation and protection.



These poles are the valuable result of many growth years, man-hours and heavy expense required to cut, trim, frame, treat, deliver and erect them as poles in the line. Are you justified in gambling with unproved wood preservatives when protecting such an investment in man-hours, manufacturing and erection expense?

Why take chances on unproved wood preservatives . . . when you can get full protection with

BARRETT COAL-TAR CREOSOTE

Only Coal-Tar Creosote gives you this long-lasting protection!

- *Time-tested and proved by over 100 years' use*
- *Defies rot, insects and marine borers*
- *Does not attack wood or reduce strength*
- *Weather-proved in every climate*
- *Retards checking and brooming*

You won't be taking chances with your valuable poles when you specify BARRETT — time-tested leader in the field of Coal-Tar Wood Preservatives.

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BARRETT DIVISION

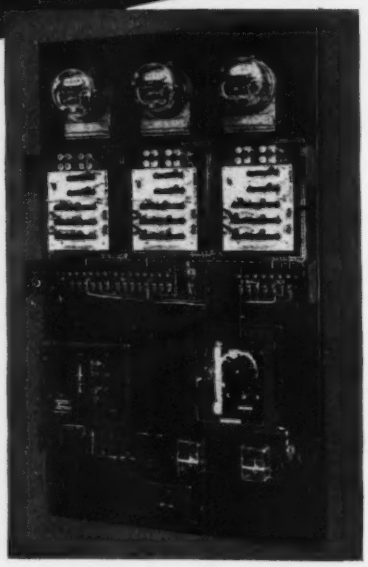
Allied Chemical

ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK 6, N. Y.

TESCO

TRANSFORMER-LOSS COMPENSATOR SAVES YOU MONEY



TESCO transformer-loss compensators on a two-element 6.6 KV 18,750 KVA metering installation with three transformer banks.

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the transformers.

The TESCO compensator is simply this: it adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . *importantly* . . . no changes are made in the meter itself, either structurally or in adjustments! It retains its integrity as a standard measuring unit.

TESCO developed the compensator for use on customers' installations where the contract provides for supplying and billing energy and demand at distribution or transmission voltages.

The compensator is produced with two- and three-element types for use with two-element or three-element meters on any type circuit.

FREE . . .

Detailed, informative booklet . . . yours for the asking. It explains fully the operation, installation, varied applications of TESCO Transformer-Loss Compensators. Write us today for your copy.

Companies Now Using TESCO
TRANSFORMER-LOSS COMPENSATORS

Philadelphia Electric Company
Public Service Company of New Hampshire
Idaho Power Company
Pennsylvania Power & Light Company
Eastern Shore Public Service Company of Maryland
New York State Electric & Gas Company
Westinghouse Electric Corporation
General Electric Company
Texas Power & Light Company
U. S. Bureau of Reclamation
Indiana & Michigan Electric Company
Atlantic City Electric Company
Utah Power & Light Company
Connecticut River Power Company
Monsanto Chemical Corporation
Louisiana Power & Light Company
Riviera Utilities
Southern California Edison Company
Northern States Power Company
Cambridge Electric Light Company
New England Power Corporation

EASTERN SPECIALTY COMPANY
PHILADELPHIA 40, PENNA.

that is raised and lowered hydraulically has been announced. Vertical clearance of machine permits travel beneath any obstacle that permits clearance for truck.

Bucket line can be extended at an angle behind the machine to start ditch flush against wall. When digging along a slope the boom and bucket line remains in a vertical position and digs a ditch from 8 to 24 in. wide, down to 6 ft deep. Power for digging speeds from one to 44 fpm is derived from the truck motor.
Owen-Pewthers Manufacturing Co, Houston, Texas

MORE NEW PRODUCTS
about which you should know

Ainsworth Manufacturing Corp, Detroit, Mich., announces a new **framing material,** called Mult-A-Frame, on which is secured potheads and transformers. Cables are supported by insulators that screw into nuts which ride in the channel . . . D. E. Makepeace Co, Attleboro, Mass., has precious metal **electrical contacts** which retain the metal's springiness.

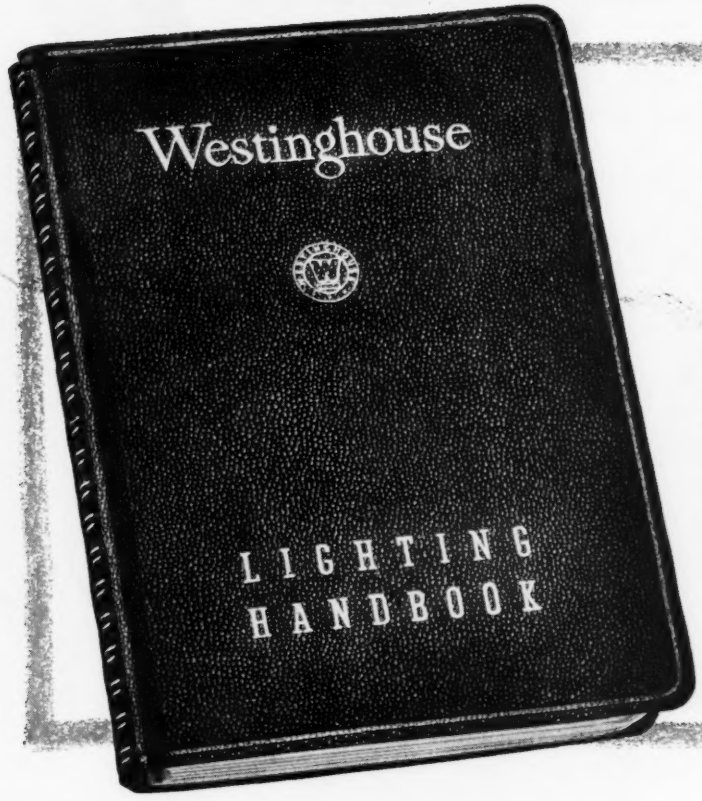
Prodelin Inc, Kearny, N. J., announces a 50-ohm VHF Teflon **coaxial line,** Series 600, that is pin type insulated . . . Boston Insulated Wire & Cable Co, Boston, Mass., has developed an all-purpose shielded **hook-up wire** for electronic and low-current applications.

Smith Control & Instrument Co, Inc, Palmyra, N. J., announces a precision **snap-action switch** for temperature control applications, rated at 10 amp, 115 v . . . Milwaukee Resistor Co, Milwaukee 4, Wis., has a line of ribwound **resistors,** rated up to 2 kw, having high-temperature refractory cores.

Inet, Inc, Los Angeles 3, Calif., announces a high-performance ac to dc regulated **selenium rectifier** with magnetic amplifier control and having rating from 1.2 to 30 v, 2.5 to 40 amp. . . . Pelham Electric Manufacturing Corp, Erie, Pa., has 28 different styles of **terminal lugs,** including single and double grip, three way and angle.

Vital Lighting Information

you'll use in the next 30 days



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CHAPTER 12	Street Lighting
CHAPTER 13	Aerodrome and Airway Lighting
CHAPTER 14	Sign Lighting
CHAPTER 15	The Cost of Lighting

actual size:
7½ x 5¼ inches– 235 pages

Most complete pocket size lighting handbook . . . yours for just $2.00

Here in one book is a ready-reference and short-cut to all the practical lighting information available today. It briefly, but completely, covers theory. It then goes into the facts and data you need. With it, you can suggest and estimate the best possible lighting—at the lowest possible cost.

This Westinghouse lighting handbook belongs in your desk or brief case. You'll refer to it many times. To get your copy promptly, please fill out and mail the coupon today!

YOU CAN BE SURE... IF IT'S

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Please send me.....number of lighting handbooks at $2.00 each.
☐ Enclosed is my check ☐ Bill me

NAME.....

ADDRESS.....

CITY.....ZONE.....STATE.....

when

Maintenance needs a hand

Maintenance men never have enough time. They have no time to replace short-lived cables when there are cables available which would have done the job right in the first place.

Replacement problems are minimized when Okoprene-sheathed cables are installed for they will not fray or festoon, thereby exposing the rubber insulation to attack. The smooth, neoprene sheath compound developed by Okonite has proved far superior to fibrous coverings in thousands of installations using millions of feet of wire and cable.

Unlike braided sheaths, Okoprene is resistant to flame, moisture, most oils and corrosive chemicals. In addition, Okoprene does not rot or deteriorate when subjected to sunlight, weather extremes and moisture. It withstands mechanical abuse. Since Okoprene is a dielectric material and provides high surface resistivity, current leakage at terminals is eliminated. Thus Okoprene need not be removed at cable ends, exposing the rubber insulation.

Solve your cable maintenance problems by installing Okoprene-sheathed wires and cables. Write for BULLETIN EW-1073 for further details on Okoprene protection. The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 *insulated cables*

75th ANNIVERSARY

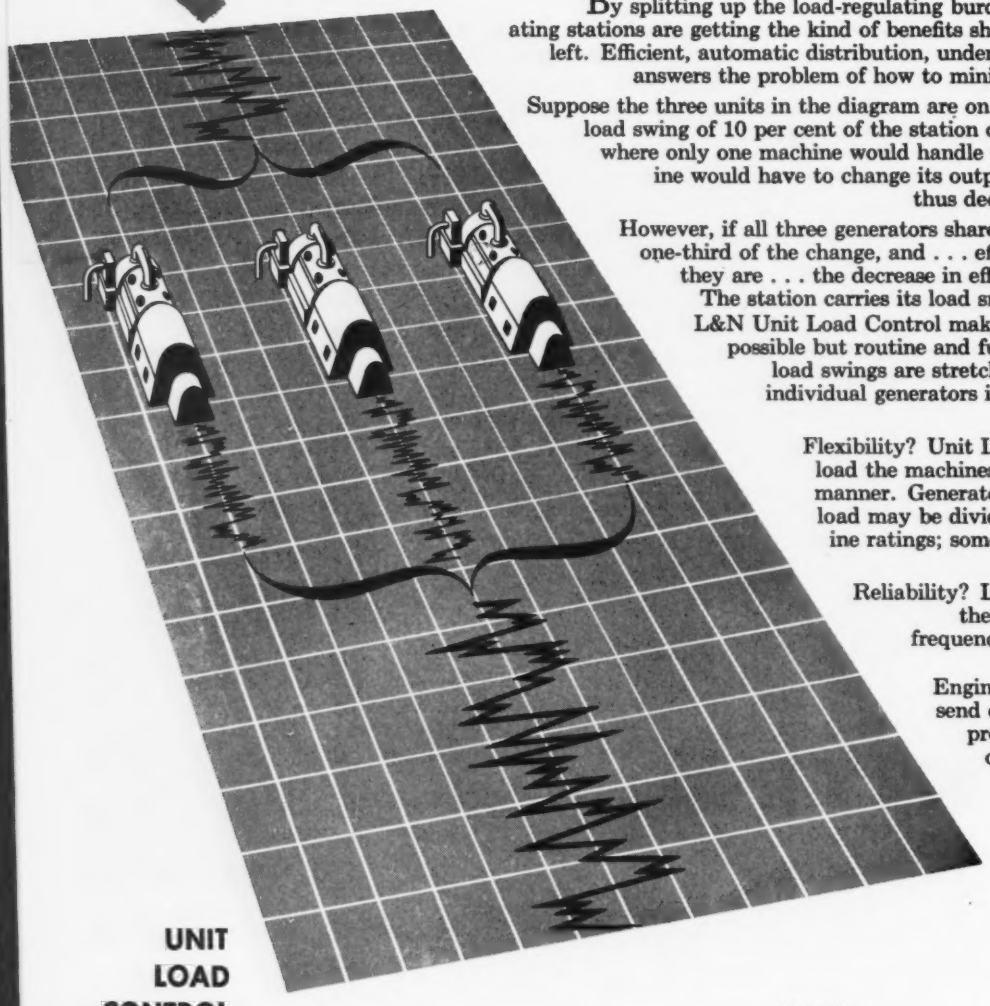
1706

LETTERS TO THE EDITOR

here's how

TO MAKE BIG LOAD CHANGES LOOK SMALL

- *Distribute station load changes...*
- *Among any number of operating units...*
- *To provide a regulated incremental output*



UNIT LOAD CONTROL

By splitting up the load-regulating burden, more and more generating stations are getting the kind of benefits shown in the diagram at the left. Efficient, automatic distribution, under L&N Unit Load Control, answers the problem of how to minimize the effects of swings.

Suppose the three units in the diagram are on the line, when a customer load swing of 10 per cent of the station output develops. In plants where only one machine would handle the regulation, that machine would have to change its output very substantially, and thus decrease the unit's efficiency.

However, if all three generators share the swing, each gets only one-third of the change, and . . . efficiency curves being what they are . . . the decrease in efficiency is sharply reduced. The station carries its load smoothly and economically. L&N Unit Load Control makes such operation not only possible but routine and fully automatic. Short-time load swings are stretched so thin that loading of individual generators is practically unaffected by fringe variations.

Flexibility? Unit Load Control lets operators load the machines in practically any desired manner. Generators may be loaded equally; load may be divided in proportion to machine ratings; some units may hold base load while others regulate.

Reliability? L&N equipment now solves the great majority of all load-frequency control problems for the power industry.

Engineering? You are invited to send details of your load-control problem to our nearest office, or to 4938 Stenton Avenue, Phila. 44, Pa.

LEEDS LN NORTHRUP

Jrl. Ad ND4-56-461(9a)

pared to the customer's resistance

LETTERS TO THE EDITOR

Reddy's Rhetoric Ratified

To the Editor:

As an admirer of that all-American Reddy Kilowatt, I wish to offer comments in his behalf regarding the argument "That's Me! vs That's I" or "The American Language vs The King's English" (E. W. July 27, p 148).

First, we should remember that Reddy Kilowatt like gasoline and bus (rather than petrol and tram) is strictly American and not the King's English.

Second, we should heed the remarks of that out-spoken Baltimorian, H. L. Mencken in his book "The American Language," page 458:

"I have noticed, however, that the use of the nominative is chiefly confined to the pronoun of the first person, and particularly to its singular. Here again we have an example of the powerful way in which *I* asserts itself.

"And superimposed upon that influence is a cause mentioned by Sweet in discussing 'between you and *I*.' It is a sort of by-product of the pedagogical war upon 'It is *me*.' 'As such expressions,' he says, 'are still denounced by the grammars, many people try to avoid them in speech as well as in writing. The result of this reaction is that the *me* in such constructions as 'between John and me' and 'he saw John and *me*' sounds vulgar and ungrammatical, and is consequently corrected into *I*.' Here the schoolmarm, seeking to impose an inelastic and illogical grammar upon a living speech, succeeds only in corrupting it still more.

"But as English spreads over the world, will it be able to maintain its present form? Probably not. But why should it? The notion that anything is gained by fixing a language in a groove is cherished only by pedants.

"Every successful effort at standardization, as Dr. Ernest Weekly has well said, results in nothing better than emasculation. 'Stability in language is synonymous with *rigor mortis*.' It is the very anarchy of English, adds Claude de Crespigny, that has made it the dominant language of the world today."

Third, we should recognize "That's me" as a colloquialism commonly used by most people and quoting further from "The American Language" (page 609):

Here's Reddy, who sticks to American-type English

"When two-thirds of the people who use a certain language," says one of his spokesmen, "decide to call it a *freight-train* instead of a *goods-train* they are 'right'; and the first is correct English and the second a dialect."

Fourth, I am enclosing an article by Rudolf Flesch entitled "The English language ain't what she used to be!" which appeared in a recent issue of "Today's Woman." This article may prove interesting to Electrical World readers, especially the following paragraph:

"So next time you feel like correcting someone else's English, remember that the rules have changed. According to science:

1. It's good informal usage to say "It's me"; "Who is this about?"; *can* instead of *may;* and so on—except for a few usages that carry a social stigma, like *ain't,* he *don't,* and the double negative.

2. It's good usage to pronounce words the way most people pronounce them.

3. It's all right to use new words that have gained popularity.

4. There's nothing wrong with modern spellings like **catalog** and **sox.**

5. A minimum of punctuation is best."

E. T. Hughes,
Engineer
Federal Power Commission
Washington 25, D. C.

Difference on Coolers

To the Editor:

I was very glad to see your editorial in the July 27 issue, "Room Cooler Problems Multiply."

It seems to be an excellent summary of the present situation with respect to supply of power to this important device.

The same issue includes F. G. Hamner's article entitled, "Today's Problems of Serving Room Coolers." A sub-heading, presumably inserted by editors of Electrical World, refers to the recent and unforeseen boom in the sale of room coolers.

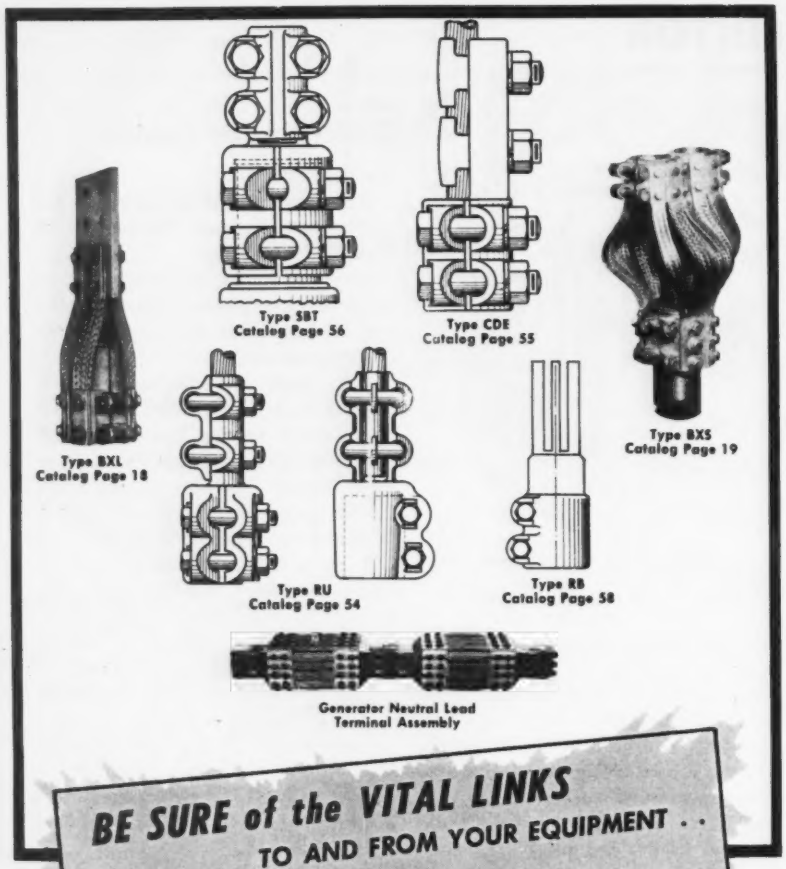
I am at a loss to understand how anyone can refer to the boom as "unforeseen"; your reporters, who have sat in on many discussions among public utility engineers for the past several years, must have heard predicted the very thing that is now happening and which you describe as "unforeseen." I also wonder about the accuracy of the word "swamped" in connection with customers' complaints.

Certainly there are complaints; but on what basis was it determined that their volume justifies such a term?

More important, however, is the fact that, although Hamner's article is quite timely and excellent in many respects, I must conclude that he is expressing principally personal opinions, at least in dealing with the subject of operating power factor. Certainly, his views are at considerable variance with those expressed during past months by important managerial representatives of the utility industry.

With respect to operating power factor, he points out that the room cooler "is no greater offender . . . than refrigerators, attic fans, furnace blowers, clothes washers, dish washers, or any other device operated by fractional horsepower motors. Because of its larger size, the average room cooler has a power factor greater than that of the foregoing devices."

What he seems not to recognize is the large diversity of use among many of the small appliances he lists, as compared to lack of diversity in room cooler operation during hot weather and, further, that these appliances, are, in general, relatively small com-



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TO AND FROM YOUR EQUIPMENT . .

Specify **Royal** STUD CONNECTORS and EQUIPMENT TERMINALS

• Royal Power Connectors have been produced in a wide variety of types and sizes for many years. They are manufactured from high-conductivity, high strength copper alloy. Multiplicity of point contacts develop the lowest resistance and highest pull-out strength. ½-inch Silicon Bronze hex head bolts are standard for conductor sizes from ½" IPS and larger, and 500 MCM and larger. Nested bolt heads permit "one wrench" installation. Write for a copy of our new catalog No. 12. You'll find it interesting, useful and informative.

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Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

pared to the customer's resistance loads. Room coolers, by virtue of their larger size, represent a larger proportion of the customer's total load, particularly when it is considered that many customers now have not one but several of these devices in the home.

Many more multi-unit installations will follow in the future. Thus the power factor of the customer's load will approach the value obtaining in the room coolers.

Hamner further states that "since the utility is in the electric power supply business, it is obligatory for it to supply whatever the customer wants, whether it be power, volts, frequency (time), current, or reactive kva." This is a very broad statement and I am sure that the industry makes every effort, within limits set by its customers' best interests, to make it a true one.

However, carrying his thought further, it might on this premise be assumed for example, that if a customer desires a device with a 100-amp locked rotor current at 115-v, it is obligatory for the utility to permit it.

It would then follow that the utility industry erred in setting up the motor starting current limits to which his article refers and which he seems to approve.

It might also be taken that any customer can make use of his electric service as he pleases without regard to the effect of his use on adjacent customers.

Along with Hamner, it is not my "intention to assume any of the prerogatives of the rate departments . . .," but I believe that it is axiomatic in the electric utility industry that any customer's bill should cover the costs of service.

It has been truthfully said many times by many people that it is not necessarily to the customer's ultimate advantage that he buy the cheapest possible appliance.

If, for the sake of argument, it is assumed that the air conditioning industry really finds it necessary to increase the price of room coolers to provide higher operating power factors, it certainly does not follow that the utility industry is wrong in asking the customer to pay some premium for a device that must in the long run result advantageously to him.

J. W. Anderson

Wayne, Pa

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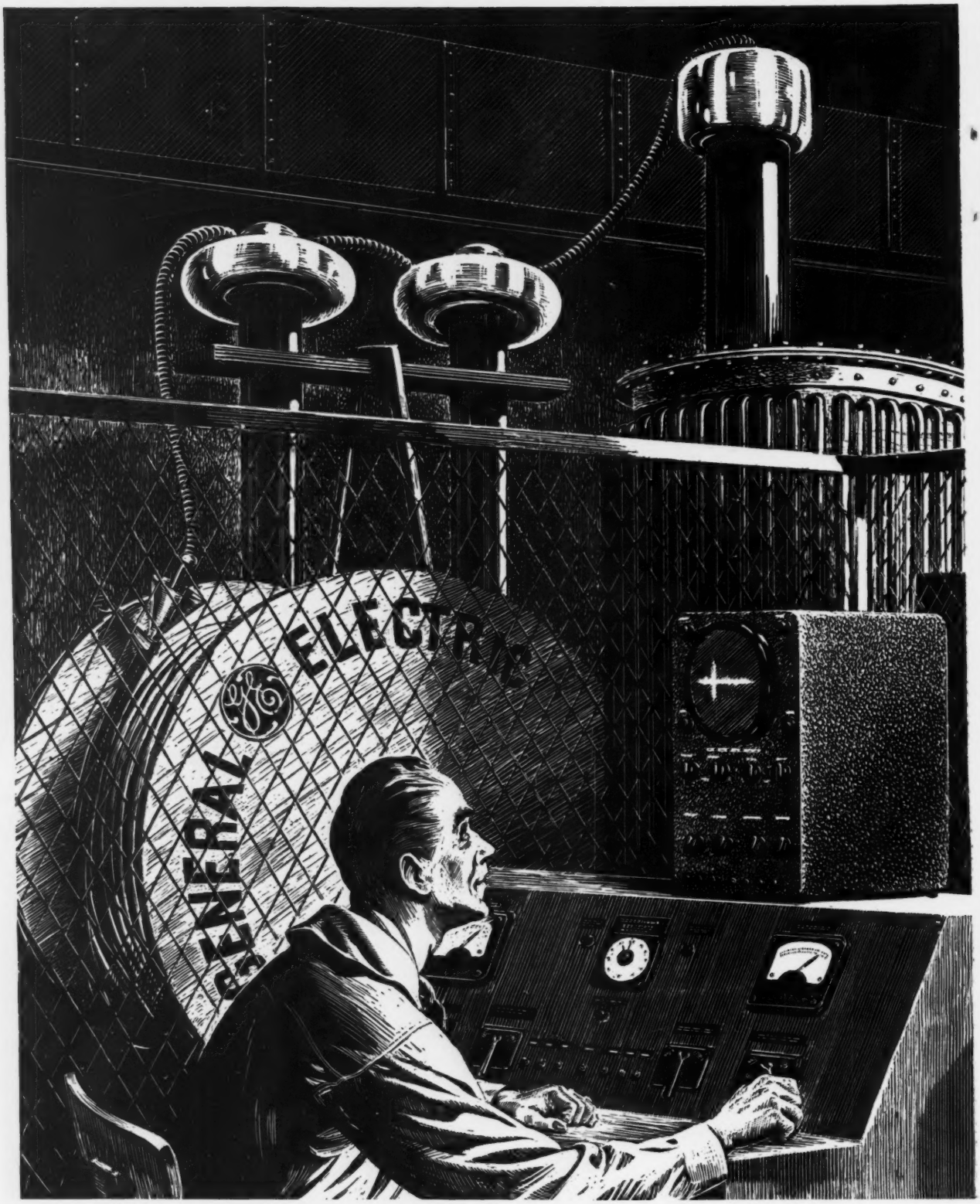

G-E Wire and Cable engineers have access to this ionization testing equipment at General Electric's High-voltage Laboratory in Pittsfield, Massachusetts. This equipment and other facilities in other departments of the Company help G-E engineers speed the development of new and better wire and cable.

General Electric's company-wide research and test facilities give you...

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YEARS OF ELECTRICAL PROGRESS

Cables that you know will meet your needs

Producing wire and cable to meet your requirements calls for both production-line test equipment and specialized test and research facilities. Because the General Electric Company manufactures an extensive line of electrical apparatus, it has a full range of specialized test and research facilities readily available to provide basic data necessary for the solution of many cable problems. G-E wire and cable engineers use this data to maintain continuing progress in the design and manufacture of wire and cable.

Production-Line Testing

All equipment necessary for thorough production-line testing is available at the Wire and Cable Department in Bridgeport, Connecticut. Typical of this equipment are Schering Bridge test apparatus for power-factor and ionization-factor testing, apparatus for measuring insulation strength and conductor resistance, and one of the few ionization testers that can handle regular production lengths of cable—in lengths exceeding 3000 feet.

Continuing Research and Development

But even the best production-line testing isn't enough. New demands in utility systems are constantly developing with resulting new demands on wire and cable. This calls for continuing research and development. As an example, use is made of the General Electric high-voltage laboratory at Pittsfield, Mass., to test impulse voltage break-down levels — in order to coordinate the insulation level of the cable with that of the other equipment in your system. At the present time G-E engineers are exploring this subject with higher-voltage Super Coronol* cable to increase reliability in service.

If the problem is high currents, the G-E Switchgear Development Laboratory in Philadelphia can test cable performance under short circuits of practically any magnitude. Other equipment at Pittsfield can simulate high-current surges of intensities up to that of natural lightning.

This testing and research program gives General Electric engineers the data necessary to predict cable performance, to design better cables that you *know* will meet your needs, and to learn more about how to use and protect cables in service. These are a few of the reasons why it's a good idea to call your General Electric wire and cable specialist whenever you have a cable problem. Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

**Registered Trade-mark General Electric Company*

You can put your confidence in—

GENERAL ELECTRIC

FACTORIES need MORE ELECTRICAL OUTLETS!

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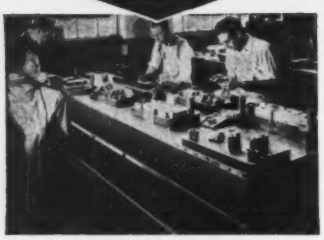
Is the FASTER, EASIER, CHEAPER way to provide multiple convenience outlets!



PLUGMOLD makes work benches more efficient!

This easy-to-install multi-outlet system gives you outlets right at the spot where they're needed — Duplex or NEMA grounded outlets every 30 inches in a continuous run. Closer spacings available if needed; also available in 3-foot and 6-foot factory-wired sections.

PLUGMOLD 2000 eliminates the hazards of a tangle of extension cords — dangerous to workers and to the work! With a PLUGMOLD outlet right at the point of use, you can use shorter cords for electrical tools.

Write today for the free Plugmold 2000 book!

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Makers of
PLUGMOLD – multi-outlet systems
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PANCAKE – overfloor raceways

THE WIREMOLD CO.
Hartford 10, Connecticut

WHAT THEY'RE SAYING

At Industry Meetings

Adequate Earnings Are a "Must"

JOHN PILLSBURY, assistant to the president of Public Service Co of New Hampshire, before Manchester Rotary Club

Since it takes over $4 of investment in property to produce $1 of electric utility revenue, the interests of ratepayers are best served when money is obtained from investors at low interest rates. Inadequate earnings will increase the cost of new money whether in the form of stock or bonds.

The electric industry can no more escape the effects of inflation than can the butcher, the construction contractor, the newspaper publisher, the post office department or any other business.

Investment by this company of over $50 million in new construction since World War II required major new financing. Despite normal growth and rates increase, revenues have not risen fast enough to offset higher labor and material costs and protect the interests of a growing number of investors, despite the fact that electricity sells for less today than in 1940. Hence the necessity for further rate increases.

Public Utility Regulation In a Competitive Society

RALPH M. BESSE, executive vice president, Cleveland Electric Illuminating Co, before American Bar Association annual meeting, Boston

The favorite argument used by advocates of the historical cost rate making formula is that this method of valuation makes the job of regulation more convenient and less difficult for the regulatory bodies. They are absolutely correct. Nothing could be simpler than to examine the accounting records of a company, find the book entries for the plant account, make the necessary other accounting and formula adjustments, and say, "This is it, boys."

It may make the task of regulation easier but only by happenstance does it ever result in equitable treatment of the regulated companies. When regulation is made so easy, it is not

EASIER TO INSTALL

PLUGMOLD 2000 with SNAPICOIL by WIREMOLD

CUTTING and FITTING reduced to a minimum

No "pre-engineering" when you install Plugmold 2000 multiple convenience outlets... every step you take gets the job done! . . . Plenty of knockouts for feeding and mounting in Plugmold 2000 base—no drilling! . . . You can feed in at any convenient point — no special fittings required! . . . Elbow fitting covers snap on and *overlap*—no precision cutting required!

Write today for new, free Plugmold 2000 book!

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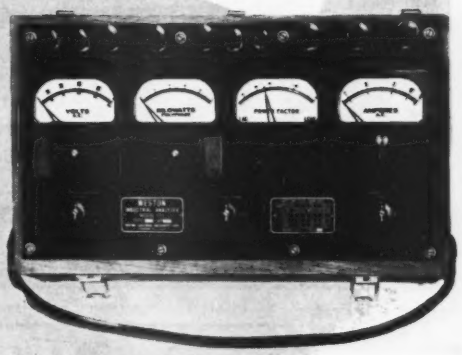
WIREMOLD'S *New* multi-outlet system

THE WIREMOLD COMPANY
Hartford 10, Connecticut

tools that Streamline electrical maintenance

FOR POWER PROBLEMS...

FOR MOTORIZED EQUIPMENT...



FOR ELECTRONIC TROUBLE SHOOTING...

WESTON A-C INDUSTRIAL ANALYZER
(Model 639) a combined Voltmeter, Wattmeter, Power Factor Meter, Ammeter . . . all interconnections made!

A real timesaver because only one hook-up is necessary to measure a-c current, voltage and power in single and polyphase circuits, as well as power factor in 3 phase, 3 wire, balanced circuits. Adequately insulated binding posts . . . high overload capacity. Furnished in compact oak carrying case measuring only 18⅞" x10⅞"x6⅞".

WESTON INDUSTRIAL CIRCUIT TESTER
(Model 785) the versatile 28 range super-sensitive portable tester.

Especially designed for checking electronic control and power equipment. Seven d-c voltage ranges: .1 to 1000 (20,000 ohms per volt) . . . six a-c voltage ranges: 5 to 750 (1000 ohms per volt) . . . six d-c current ranges: 50 microamperes to 10 amperes . . . four a-c current ranges: .5 to 10 amperes . . . five resistance ranges: 3000 ohms to 30 megohms . . . all ranges full scale . . . a-c and d-c current ranges extended with external transformer or shunts. New temperature compensated rectifier circuit gives greater a-c accuracy.

WESTON CLAMP VOLT-AMMETER
(Model 633) measures current and voltage without breaking circuits and disrupting operations.

Combines in one instrument five full-scale a-c current ranges of 1000/250/100/25/10 amperes with range overlap for good readability . . . three self-contained a-c voltage ranges of 700/350/175 volts, with instrument insulated for 750 volt service. Has convenient 6-position thumb switch for range selection, and adjustable pointer stop for measuring motor starting current.

AVAILABLE THROUGH LEADING DISTRIBUTORS

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Pull Lead Covered Cables

The "old reliable" IMPROVED compound . . . just brush it on cable . . . unaffected by summer heat or zero temperature . . . clean to handle . . . easy to wipe off . . . sticks to sheath even in water-filled ducts . . . actual dynamometer tests show greatly reduced pulling stresses . . . send for further data and free working sample NOW.

Easier with . . .

ALBANY

Improved Cable Pulling Compound

and for wires with rubber or other coatings, use

RBR

Will not affect rubber or other coatings . . . excellent for nonmetallic cable . . . permanent . . . allows easy wire removal in later years . . . nonevaporating . . . needs no mixing . . . will not separate or harden . . . light, clean to use, can be washed off with water. Send for further data and free working sample NOW.

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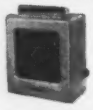
Handsomely styled Wall-type and Portable models, capacities from 1320 to 4000 watts, for homes, offices, motels, lobbies, churches, institutions. *Wall-type Down Flo illustrated.*

INDUSTRY MODEL 14-10

Scientifically engineered Unit Heaters in Portable and Suspension-type models, capacities 1.5 to 45 K.W., for factories, isolated locations, hard-to-heat areas. *Suspension-type illustrated.*

FARM MODEL FA-15



Especially designed for the Milk House, capacities 1500 and 3000 watts. Prevents water pipes freezing, keeps area dry, aids ventilation. Also used for brooder pens and vegetable bins.

- ✓ **QUICK, EASY TO INSTALL** — No ducts, pipes, radiators
- ✓ **MINIMUM MAINTENANCE** — No fuel to order or store
- ✓ **AUTOMATIC CONTROLS** — Uniform temperatures
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Send for FREE LITERATURE . . . full of specifications, illustrations, installations, diagrams and how to figure electric space heating.

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Leader in Electric Heating Since 1929

necessary to worry whether qualified people are hired as regulators. No expert opinion is needed, or even wanted, if regulation is to become the mere application of a fixed formula to hold good even though changed conditions may make the results of such application seem ridiculous.

The utility companies have to share the blame for the adoption of this original cost theory of valuation. They did not vigorously fight its application in the beginning because price levels were relatively stable at that time. They were not far-sighted enough to see how the use of this method might endanger the very foundations of private ownership in the utility industry. They are quite aware of the danger now.

In competitive industry the rate of return received reflects the factors of pure interest, risk, financing costs, and reward for efficient management, plus an amount to be retained in the business. Therefore, if regulation is to be a substitute for competition, the regulatory bodies are obliged to allow public utilities a rate of return which reflects these factors.

It's Only the Beginning For the Heat Pump

EDWIN FLEISCHMANN, consulting engineer at 18th annual conference of International Association of Electrical Leagues, San Francisco

Given a few years of intensive development which has been promised, the reversed refrigeration cycle, or heat pump should greatly broaden the electric air heating field.

The importance of the present developmental work on this subject is twofold. First of all, the heat pump has coefficients of performance of 3 or 4, which means that, for each kwhr of input to the compressor, the effect of 3 to 4 kwhr of direct resistance heating is obtained.

Secondly, the same machine may be used as a cooling device in summer, as well as for heating in winter. Both of these features open attractive vistas so far as cost of operation is concerned.

The growth in the number of heat pump installations has recently been reported on. From only 160 heat pump installations in the entire country in July 1947, the total has risen to 1,054 as of March 1953. In the latest report there are one or more heat

THE RIGHT TAPE FOR HOT SPOTS

(*It belongs in your tool box*)

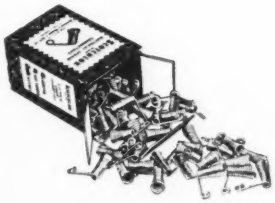
Why risk using an ordinary insulating tape for high-heat application? Use the *right* tape for the job—"Scotch" Electrical Tape No. 27—and save yourself from the danger of insulation failure, costly re-wiring.

Glass cloth backing and thermosetting adhesive make No. 27 tape tough when the heat's on! The backing won't burn, stretch, shrink or rot. The adhesive cures in 1 hour at 300°F to form a permanent bond of great strength—and it *lasts*. Curing increases the dielectric strength about 500 volts.

Order "Scotch" Electrical Tape No. 27 today! And when you're ordering, check your supply of the four other "Scotch" Electrical Insulating Products shown below. Always demand the dependable "Scotch" Brand!

"SCOTCH" Plastic Electrical Tape No. 33 is available in 66 ft. x ¾ in. rolls in individual cans, and "Job Size" Rolls—20 ft. x ¾ in. —packed 12 to a screw-top fibre container that keeps out dust and dirt, prevents bruising.

"SCOTCHFIL" Electrical Insulating Putty is ideal for padding sharp edges on bus bars and connectors. Comes in a roll, applies like tape. Can be moulded with moderate finger pressure to eliminate voids and air pockets. 1½ in. x 5 ft. rolls.



"SCOTCHLOK" Electrical Spring Connectors are a new twist in splicing — both a pressure and a fixture-type connector. One size handles wire combinations from Awg 10 down to Awg 16. Just twist on wires, break off the stem, and wrap with tape.

"SCOTCHKOTE" Electrical Coating is a strong, fast-drying over-coating for taped wire and cable splices subjected to abnormal weathering or moisture conditions. Resists sunlight, soil acids, oil and aliphatic hydrocarbons. 5 oz. tubes.

The term "Scotch" and the plaid design are registered trademarks for the more than 200 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ont., Can.

SCOTCH BRAND Electrical Insulating Products

WHITE 3000 KEEPS TRUCK COSTS DOWN!

Utilities Report More Work Done In Less Time With The White 3000

HAVE YOU looked into this *new* kind of motor truck for *your* transportation needs?

Here's new truck efficiency tailored right to your operating requirements and service needs because the White 3000 is engineered to *your* work.

Its functional design makes it more maneuverable . . . safer . . . more efficient. It saves time in traffic—saves time at every stop. It saves space on the street, in the garage.

And its power-lift cab substantially reduces maintenance cost because complete front-end is available for inspection and service, instantly.

Your White Representative will be glad to make a Truck Evaluation of your transportation needs. It's the first step toward *new* truck efficiency and economy in your business.

THE WHITE MOTOR COMPANY
Cleveland 1, Ohio

White 3000 Supply Trucks... Aerial Units . . . Line Trucks Help Industry Save Time

This White Model 3022 is one of four in the service of Southern New England Telephone Co. This supply truck is loaded at the New England plant and keeps supply line going all night long . . . saves time between plant and telephone depots.

White 3000

FOR MORE THAN 50 YEARS THE GREATEST NAME IN TRUCKS

pumps in every state of the Union except nine: Arkansas, Maine, Massachusetts, Nebraska, New Hampshire, New Mexico, North Dakota, Vermont, and Wyoming.

Merchants, Not the Customers Must Set Retail Prices

KENNETH L. HAMPTON, manager, Valley Electrical Supply Co, Fresno, Calif., at 18th annual conference of International Association of Electrical Leagues

Letting customers set your retail prices is an age-old way of going out of business. It has been practiced without success by would-be merchants for centuries.

The merchant, like any other worker, is worthy of his hire. The bugaboo in his affairs is the element of cost of doing business complicated by the fact that he handles sums of money as a clearing house for others. In the processes of buying and selling, he handles 20 or more times as much money as he earns. He is custodian of this money and may easily divert it to meet his expenses, salary and even return on his capital unless he both understands his responsibility well and knows his cost of doing business intimately.

Overnight Success Is Not Hallmark of Appliance Field

W. H. EICHELBERGER, vice president in charge merchandising, Philco Corp, refrigeration division, at 18th annual conference of International Association of Electrical Leagues, San Francisco

Enthusiasm, many times, colors our better judgment. We hear stories of tremendous sales. We have visions of becoming millionaires in one short 3-month period. If we are not ready, if we miss just these three months, the opportunity has gone forever.

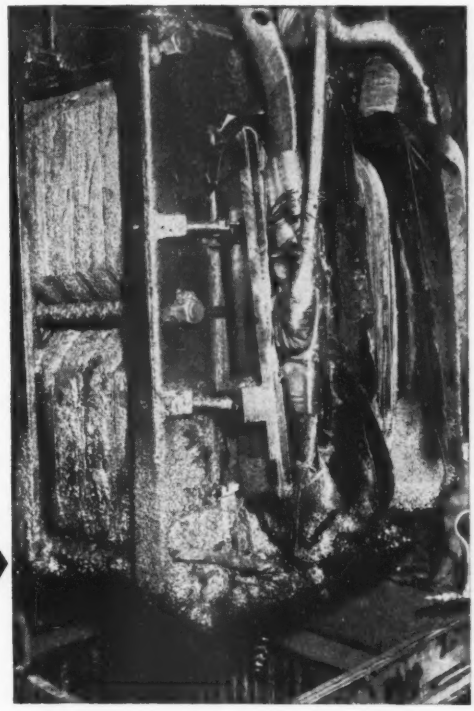
That may be true in all oil wells—it may be true in the stock market, but it has never happened in the appliance business. Speed has never counted compared to quality and reputation.

Acceptance and demand—these things take time. They have to be earned and in this business there is time. It takes years to saturate this country and even then we are just starting because of new developments, new features, and new engineering.

Add DBPC

to your transformer oils . . .

to guard against sludge



• DBPC (Di-tert-butyl-para-cresol), added to transformer insulating oils, minimizes the development of sludge deposits, such as illustrated. DBPC slows down the rate of oxidation, retards sludge formation, adds extra life to the insulating oil, and promotes more efficient transformer operation.

Under accelerated oxidation tests, oil inhibited with only 0.3% DBPC has proved that it can outlast untreated oils by 14 times. The saving with DBPC is obvious.

In addition to its use as an oxidation inhibitor for transformers, DBPC can also be used in circuit breaker oils. Used here it does not affect arcing time, rate of gas generation, carbon formation or dielectric change.

DBPC is available in a white-to-yellow crystal that is readily soluble in oil and which can be added to either new or reclaimed oil. Or it can be purchased in a compounded oil solution under the Koppers trade name Impruvol 20. Specify DBPC inhibited oil to your transformer manufacturer or your oil supplier. Or order DBPC directly from Koppers.

KOPPERS®

Koppers Chemicals

KOPPERS COMPANY, INC.
Chemical Division,
Dept. EW-9213, Pittsburgh 19, Pennsylvania

Georgia Power Elects 2 VPs

J. F. Pennington, operating manager, is promoted to vice president. C. M. Wallace replaces retiring VP Collier

J. F. PENNINGTON

Georgia Power Co has elected **J. F. Pennington** vice president in charge of operations and C .M. Wallace, Jr, vice president in charge of sales.

Pennington has served as operating manager since 1950. Wallace, who succeeds Charles A. Collier, has been sales manager since 1951. Collier, who will retire as vice president in charge of sales Oct. 1, will be retained by the company as a vice president for six months to complete pending power contract negotiations. He also will continue as a director.

C. M. WALLACE, JR

Began as Construction Helper . . . Pennington joined the utility in 1918 as a construction helper. After serving successively as electrician, foreman, assistant superintendent, general superintendent of transmission and distribution, he was named operating manager three years ago.

Wallace started with Georgia Power in 1928 as a student engineer. He served as power salesman, lighting engineer, and division sales supervisor in Atlanta before becoming sales manager and assistant to Collier in 1951.

Collier has been identified with the utility field since 1909. He was general sales manager of the company for five years prior to being elected a vice president in 1927.

•

A. M. Fisher, formerly Chicago district manager of the Apparatus Division of Westinghouse Electric Corp, has been appointed Mid-America regional manager to succeed the late Fred T. Whiting (EW, Sept. 7, p 155). Fisher has served Westinghouse for 24 years.

F. W. Borchers, assistant sales manager of Bristol Co, since 1948, has been promoted to general sales manager of the company. Borchers, who joined Bristol in 1922, will maintain his headquarters at the company's main office at Waterbury, Conn. Bristol also appointed **D. C. Sanford** manager of its application engineering department with headquarters at Waterbury. Sanford, formerly application engineer, joined Bristol's sales engineering staff in 1937.

W. C. Stratton has been appointed superintendent of design of Ebasco Services Inc's Design Division to supervise all Ebasco design and drafting activities. Ebasco also named **H. T. Canfield** assistant construction manager of its Construction Division to handle New York office construction activities. Stratton, formerly assistant to the company's engineering manager, has been closely identified with public utility construction since 1934. Canfield, previously superintendent of design, had wide experience in design and construction of electric utility and industrial projects before joining Ebasco in 1942.

William D. Jameson has joined Electric Service Manufacturing Co, Philadelphia, as general sales manager. He was formerly affiliated with Yale & Towne Manufacturing Co. Under the general reorganization of Electric Service's sales program, **Vice Pres I. W. Schmidt** will direct a new department of market research. The company also appointed **Harold A. Geatrell** as advertising and sales promotional manager.

M. R. NORTON

Wisconsin P&L Assigns Norton to Executive Post

M. R. Norton, acting general sales manager of Wisconsin Power & Light Co since April 1, has been promoted to general sales manager of the company. Wisconsin P&L also elected J. D. Howard assistant to the vice president in charge of operations.

Since joining Wisconsin P&L in 1932, Norton has served in various sales capacities. He was dealer sales promotion manager at Madison before assuming the post of acting general sales manager.

An employee of Wisconsin P&L

since 1934, Howard was appointed

Steel

The World's Largest Stocks

•

Certified Quality—Carbon, Alloy, Stainless

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Fifteen Plants from Coast to Coast

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Metallurgists and Veteran Steel Men

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Sawing, Shearing, Flame Cutting

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Immediate Shipment

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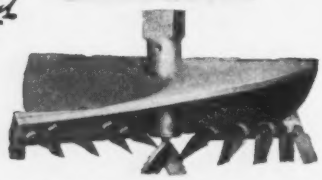
PRINCIPAL PRODUCTS IN STOCK: CARBON, ALLOY AND STAINLESS STEELS • BARS • STRUCTURALS • PLATES • SHEETS TUBING • METAL WORKING MACHINERY AND TOOLS • GLYCO BABBITT METAL • RYERTEX PLASTIC BEARINGS

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

THESE PENGO PRODUCTS SAVE YOU MONEY!

THE PENGO EARTH AUGER



★ Twin helix—no back thrust!

★ Bores true, clean holes in any soil, most sandstones and hardpans, frozen ground, permafrost!

★ All wearing parts replaceable on job!

★ Made in 22 sizes, 9" to 72" hole diameters, to fit all makes of heavy-duty earth boring machines. Larger sizes on order.

THE PENGO CUTTING HEAD

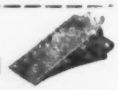
★ Easy installation—welds to your present helix.

★ Bores where you never could before!

★ Wearing parts are replaceable on the job and are interchangeable with PENGO Auger parts. *(Described at left.)*

★ Made in 11 sizes, 8" to 24" diameters. Larger sizes on order.

THE PENGO WISDOM TOOTH



★ All PENGO Augers and Cutting Heads are equipped with the drive-on PENGO Wisdom Tooth, specially designed for use on earth augers; cast from special abrasion and shock-resistant steel alloy for *far* longer service life!

"Get the PENGO WISDOM TOOTH—*It knows how to bore holes!*"

★ SAVE HOURS . . . SAVE DOLLARS!

WITH

PENGO *Triple Flight* ANCHOR AUGERS

***Especially designed to bore holes for* EXPANDING ANCHORS**

★ Double-helix cutting head eliminates back-thrust, quickly bores true and clean.

★ Triple-flight single helix carries bigger load of dirt from hole . . . you can complete a hole with less than half the trips down and up!

★ Extra-long auger with small-diameter center shaft leaves plenty of room for dirt and rocks . . . no clogging or jamming!

GET THE PENGO "Wisdom Tooth" IT KNOWS HOW TO BORE HOLES

★ Uses same fast-cutting replaceable PENGO Pilot Bits and PENGO Wisdom Teeth used on all PENGO Earth Augers and PENGO Cutting Heads.

★ Available in 9", 11" and 13" diameters for 8", 10" and 12" expanding anchors, respectively, to fit all popular makes of earth-boring machines.

★ ORDER NOW—OR WRITE FOR FREE LITERATURE, PRICES

PETERSEN ENGINEERING CO.

MANUFACTURERS

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Use this Handy coupon!

SEND COMPLETE LITERATURE AND PRICES ON

☐ PENGO earth augers

☐ PENGO cutting heads

☐ PENGO anchor augers

CLIP THE ATTACHED TO POSTCARD OR BUSINESS CARD EW 9-53

since 1934, Howard was appointed last April as acting district manager at Beloit, a post he filled until the present appointment.

Harry M. Rankin has retired as vice president in charge of engineering and production for Metropolitan Edison Co, Reading, Pa. He will remain active as a consulting engineer for General Public Utilities Corp.

Westinghouse Makes Staff Changes at Coast Plant

Westinghouse Electric Corp reports manufacturing and repair activities on the Pacific Coast have grown so rapidly that management of the operation has been divided.

George F. Gayer has been named manager of the Sunnyvale, Calif., plant, which will now operate as a separate unit. Leonard N. Goodell was appointed district manager of the Manufacturing and Repair Division with plants in Huntington Park and Emeryville, Calif; Portland, Ore; Seattle, Wash., and Salt Lake City, Utah.

Joseph R. McGilvray, who has managed Sunnyvale and Pacific Coast District Manufacturing and Repair since 1947, becomes assistant to the vice president as co-ordinator of the newly separated activities.

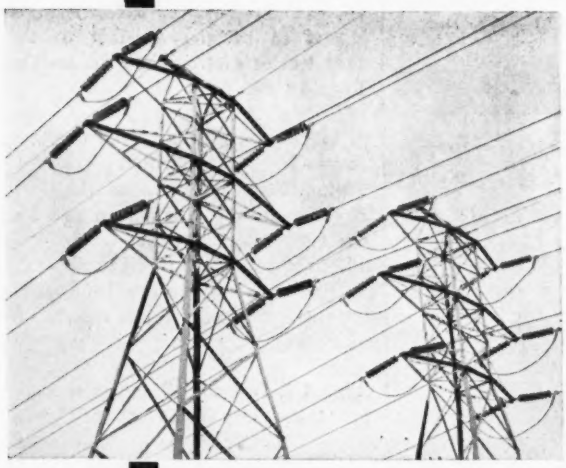
Gayer is former assistant plant manager at Sunnyvale. Goodell came to Sunnyvale in 1950 as assistant to the manager. The plant will now operate with Richard A. Gieseker as assistant manager. He is a former staff supervisor for McGilvray.

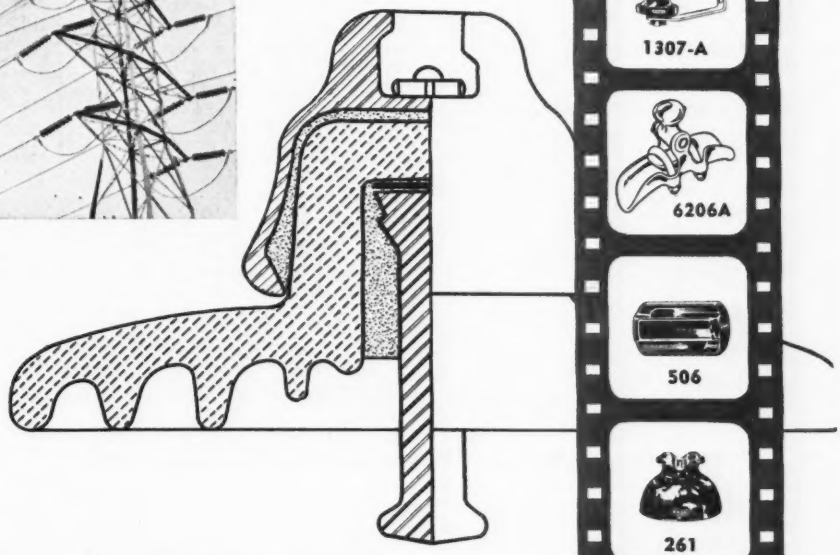
•

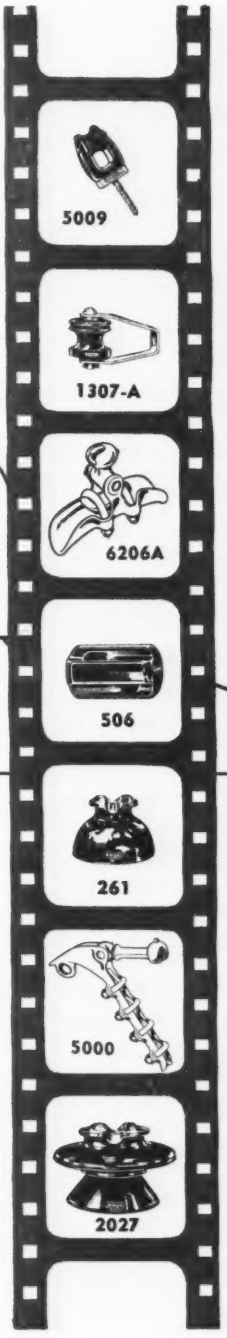
A. H. McDowell, Jr, has been elevated from assistant manager to manager of the Richmond district of Virginia Electric & Power Co. He succeds George E. Kidd, who was elected a vice president (EW, Sept. 14, p 29). McDowell joined Vepco in 1928.

Florent E. Verdin, who resigned recently as director of personnel for Cleveland Electric Illuminating Co. has been retained by the utility as personnel consultant. **Alex J. Paull,** assistant director of personnel since 1950, was named to the post formerly filled by Verdin, who has established

KNOX PORCELAIN CORP.







made better.. to last longer

Build your next high voltage line with KNOX Insulators . . . you'll find they are rugged and dependable . . . made to last longer. Companies installing KNOX Insulators and Hi Line Hardware agree they get superior service and performance regardless of weather conditions. KNOX Insulators are quality made and rigidly inspected to meet laboratory tests and specifications. Our ample stocks insure PROMPT delivery.

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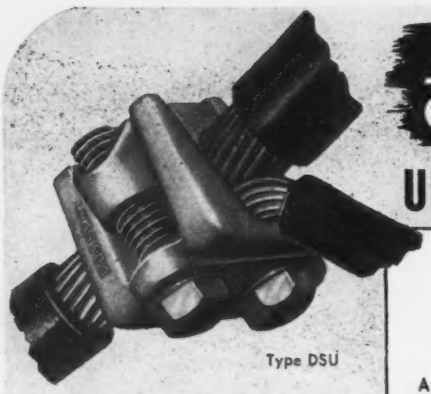

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DOSSERT Connectors

UNEXCELLED!

FOR QUALITY...
DEPENDABILITY...
PERFORMANCE...

DOSULON

A one-piece bolt type variable service tap. Available in conductor sizes from 1/0 to 1000 MCM in copper or equivalent all-aluminum or ACSA cable sizes in type DSUN. Made of high strength copper alloy and equipped with bronze bolts. Rugged compact, facilitates neat taping.

For copper connectors—write for Cat. No. 53-3

For aluminum connectors write for Cat. No. A54-3

Immediate delivery on all standard items. Prompt delivery on specials.

VARIABLE HERCULON CONNECTORS

For power distribution jobs. Available in eight sizes to cover range of cable No. 8 solid to 1,000 MCM.

HL-2

H2L-2

H3L-2

HC

For use with aluminum, specify type DSUN

DOSSERT MFG. CORP.

249-255 HURON STREET, BROOKLYN 22, N. Y.

SINCE 1904

The 7-Range Clip-On Volt-Ammeter

FERRANTI

Offers These Important Advantages

- Measures up to 1000 amps up to 600 volts.
- Convenient ONE HAND operation trigger action.
- Thumb operated range selector switch.
- 7 ranges 5 current and 2 voltage.
- Insulated core shockproof construction.
- Takes cables up to 2¼" diameter.
- Distinct calibrations easy to read.
- Suitable for 50-70 cycles.

RANGES: 0-10 amps; 0-25 amps; 0-100 amps; 0-250 amps; 0-1000 amps; 0-150 volts; 0-600 volts.

FERRANTI ELECTRIC, INC.

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

FERRANTI, LTD., Hollinwood, England

FERRANTI ELECTRIC, LTD., Toronto, Canada

a national management counseling firm with headquarters in Cleveland.

George E. Hill, commissioner of Maine's PUC since 1942, has resigned to become assistant to the president of Metropolitan Edison Co, Reading, Pa.

J. L. Gibson, assistant chief engineer for the Frigidaire Division of General Motors Corp, has been named chief engineer of the division to succeed the late S. M. Schweller (EW, Sept. 14, p 30). With the Frigidaire engineering department since 1926, Gibson was appointed assistant chief engineer three years ago.

Arnold J. Beyer, assistant chief engineer at the Gary Steel Works of United States Steel Corp since 1950, has been appointed division superintendent of power and fuel at that works. Beyer's former post will be filled by **Raymond N. Ali,** formerly assistant chief engineer at the Clairton (Pa.) Works of U. S. Steel.

William J. Thomas, general sales manager of the Tubular Products Division of Babcock & Wilcox Co at Beaver Falls, Pa., since 1948, has been named general manager of the division. **Paul J. Utnehmer,** works manager, has been appointed to the division's board of directors.

Henry G. Wells, former member of the Massachusetts Department of Public Utilities, has been appointed a member of the New Hampshire Public Utilities Commission.

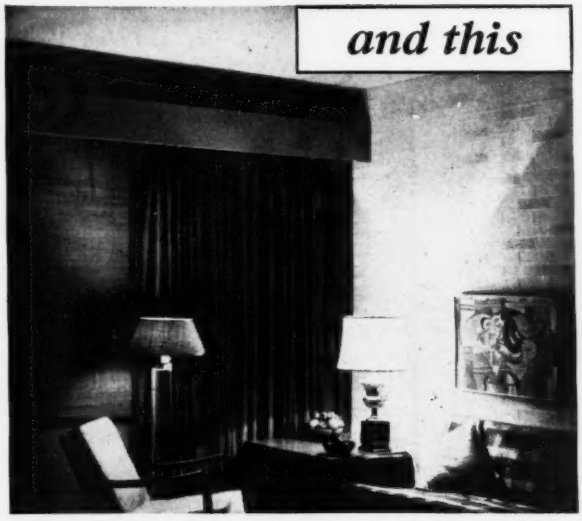
George P. Hough has been appointed general manager of A. O. Smith Corp's Permaglas-Heating Division at Kankakee, Ill. Hough, however, will continue his duties as an assistant to the president of the firm in the North Central region with headquarters in Chicago.

George F. Prestwich has been advanced from supervisor to superintendent of Philadelphia Electric Co's Coal Bureau and Steam Heating Division. Prestwich began with the utility in 1924.

Dr Raymond R. Ward of General Electric Co's engineering department at the Atomic Energy Commission's Hanford Works, Richland, Wash., has been transferred to Schenectady, N. Y., as manager of advanced de-

Big G-E Light Conditioning promotion features portable lamps and lighted valances

shows home-owners how to...



G-E Fall advertising in leading magazines, on TV and radio offers tie-in opportunity for you! This Fall, full-color, full-page ads in Better Homes & Gardens, Saturday Evening Post, commercials on the Jane Froman TV show and spot radio will be working with you to improve the lighting in the homes in your community. General Electric's advertising spotlights the advantages in comfort and home beauty that an adequate number of well-designed portable lamps and lighted valances bring to a room. Why not plan to tie-in with a local promotion of your own? For more information, contact your local G-E Lamp district office or write General Electric, Dept. 166-WE-9, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC

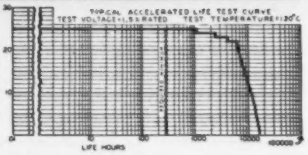
Further Proof of

Getting to the bottom of things

. . . is most clearly demonstrated by what we are doing every hour of every day — year in and year out — to make a finer fixed CAPACITOR.

One of the many things you as users are interested in is the "LIFE OF THE CAPACITOR" under a multitude of operating conditions. We in the FAST organization have spared no expense to give you honest-to-goodness answers on this important factor in providing quality capacitors.

What follows is a summary of what we are doing to give you just that . . .



I: RESEARCH and DEVELOPMENT TESTS

AC and DC tests at various temperatures and voltages.

1—Investigation of Impregnants: (a) New impregnants AC—synthetic and natural oils. DC—oils, resins and waxes. (b) Studies of impurities and additives.

2—Investigation of electrode separators and electrode materials: (a) Modified kraft papers—low PF varieties and sundry densities. (b) Films—regenerated cellulose, polystyrene, teflon, "Mylar"*, Etc.

3—Number of groups tested: AC; over 800 involving more than 8000 units. DC; over 3300 involving more than 70,000 units.

4—Duration of tests: AC; many have been continuously under test for over 6 years. DC; many have been continuously under test for over 10 years.

5—Voltage range of tests: AC; 70 to 2400 volts at 60 and 400 cycles. DC; 140 to 44,000 volts.

6—Temperature range of tests: AC; Room to 130°C. DC; —55°C to +150°C.

II: PRODUCTION TESTS

A. Alternating Current

1—Heat runs on production lots—ultimate surface temperature rise.

2—Ultimate life hours of current production (periodic tests run).

B. Direct Current

1—Civilian Production: (a) ultimate life hours of capacitors taken from current production. (These test runs comprise over 1600 groups involving more than 16,000 units)

(b) Ultimate life hours of capacitors after being stored in cartons from 1 to 24 months under normal variations in humidity and temperature. (These test runs comprise over 230 groups involving more than 2300 units)

2—Military Production: (a) Test to applicable specifications (Jan. C-25; Jan. C-91; U. S. Army 71-1667; Etc.)

(b) These test runs comprise over 3300 groups involving more than 19,000 capacitors.

Please note Carefully: at least 80% of the 115,300 capacitors included in the above tests were tested to destruction at voltages from 1½ to 4 times rated and at maximum rated—or in excess of—operating temperatures. Many outside this group have not failed to date. Importantly too, this is a continuous policy of the company in sustaining our testing program throughout every day —year after year.

So with pardonable pride may we suggest QUALITY CAPACITORS is more than a "catchphrase" as applied to the FAST organization . . . and another link in the chain of GETTING TO THE BOTTOM OF THINGS?

* *Du Pont trade-mark for Polyester Film*

JOHN E. FAST & CO.

Capacitor Specialists For
Over A Third of A Century

3165 North Pulaski Road, Chicago 41, Ill.

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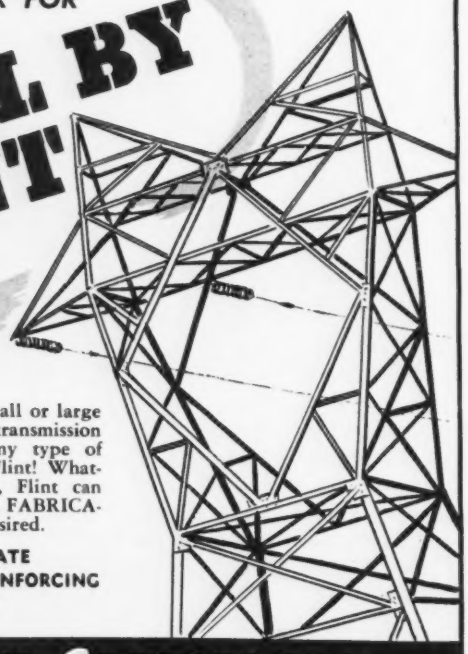
ALWAYS ASK FOR

STEEL BY FLINT



Need Galvanized Steel in small or large quantities for substations, transmission towers, switch yards or any type of exposed construction? Call Flint! Whatever your construction job, Flint can provide you with the STEEL, FABRICATION and ERECTION if desired.

- STRUCTURAL
- PLATE
- WAREHOUSE
- REINFORCING
- GALVANIZED

FLINT STEEL CORPORATION

P. O. BOX 1289 TULSA, OKLAHOMA

velopment in industrial heating. A metallurgist, he has been with the company since 1942, and since 1946 at Hanford.

O. J. Horrom, engineer and sales engineer-service adviser for Montana Power Co, has been appointed commercial sales supervisor of the company's business development department with headquarters at Butte. The utility also named **Edmund D. McGonigle** supervisor of that department. Horrom has been with Montana Power since 1931. McGonigle, who also joined the company in 1931, has served as a service adviser in the Butte Division's business development department since 1945.

Ralph Longstaff has been elevated from assistant superintendent to superintendent of meters of Kansas Gas & Electric Co to succeed **C. E. Matson,** who has retired. A. E. Sabin succeeds Longstaff as assistant superintendent of meters. Longstaff joined Kansas G&E in 1929. Sabin, who started with the utility in 1938, has served as a meter test engineer since 1949.

Norman B. Baylis has been appointed a member of the Delaware Public Service Commission for a term of six years by Governor Boggs. Baylis succeeds Commissioner Walter C. Phillips, whose term of office expired on Sept. 1.

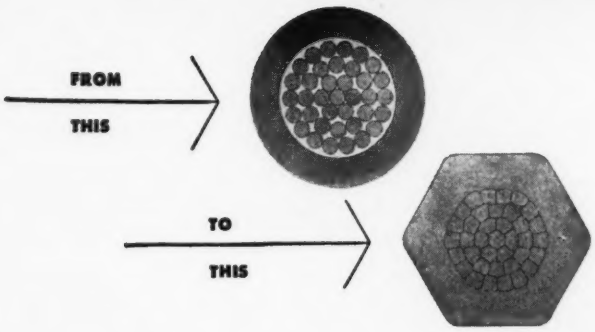
OBITUARY

Guy L. Benson, 66, transmission consultant and former superintendent of transmission of Western Massachusetts Electric Co, died recently. He had served with the utility almost 48 years.

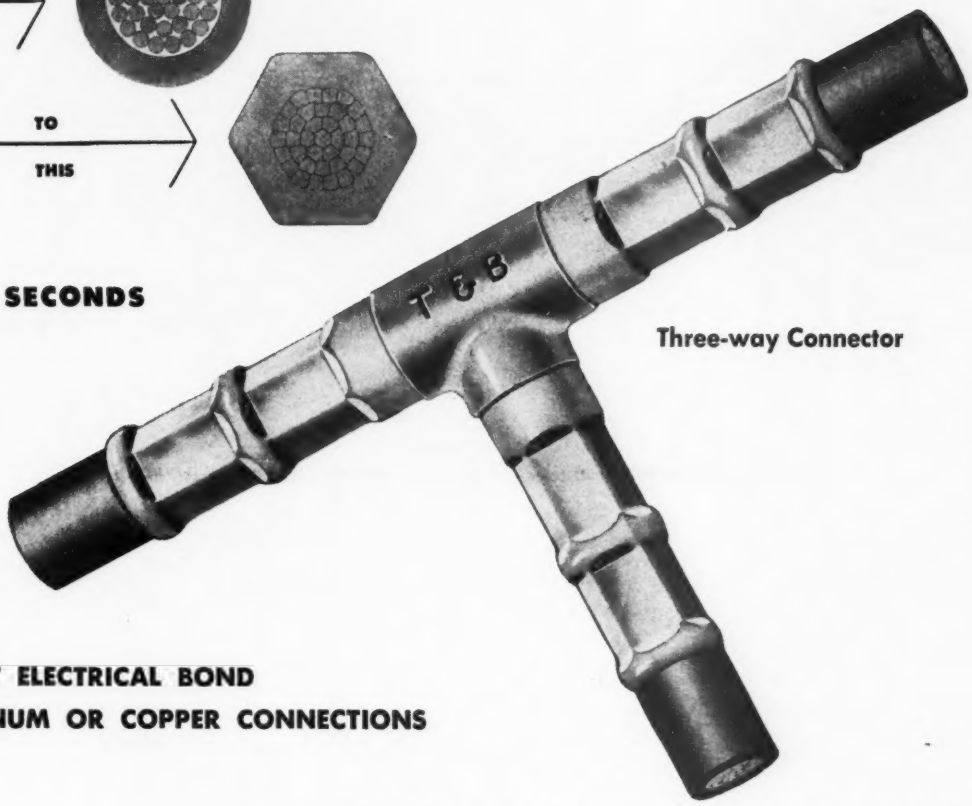
E. Clinton Jansen, 74, retired chief hydraulic engineer of Public Service Co of Colorado, died Sept. 1 at Denver. Jansen, who joined the Public Service organization in 1913, retired in 1946.

John A. Cleveland, 73, who retired in 1947 after 31 years of service with Consumers Power Co, died Sept. 1 at Grand Rapids, Mich. During his career with the utility, he served as division manager at Saginaw and Grand Rapids.

T & B METHOD



...IN SECONDS



Three-way Connector

THE PERFECT ELECTRICAL BOND
FOR ALUMINUM OR COPPER CONNECTIONS

The sign of a perfect electrical compression joint is the T & B hexagonal connector barrel — look for it. The electrical characteristics of a T & B METHOD connection are better than an equal length of conductor . . . either aluminum or copper.

The hardened steel dies of a light-weight, portable T & B hydraulic tool compress around the joint with tremendous hexagonal pressures and force the fitting and cable, into one homogeneous mass . . . all in a few seconds. The all-around pressures exerted over a large area assure maximum contact . . . minimize electrical resistance and voltage drop.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD *aluminum* connections, no joint compounds are needed to obtain maximum electrical efficiency. For *copper* connections, no special cable treatment is required. T & B METHOD fittings for aluminum have fine serrations inside the barrel which, during compression, penetrate the insulating film of aluminum oxide on the outside cable strands. At the same time, the oxide film on the inner cable strands is effectively abraded, thereby maintaining a dense, tight joint of high conductivity.

Investigate the complete line of T & B fittings for aluminum and copper cable — they offer you savings in time and installation costs. Write for your free copy of T & B Bulletin #67.

LOOK FOR THIS SIGN —

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T36

THE THOMAS & BETTS CO.

INCORPORATED

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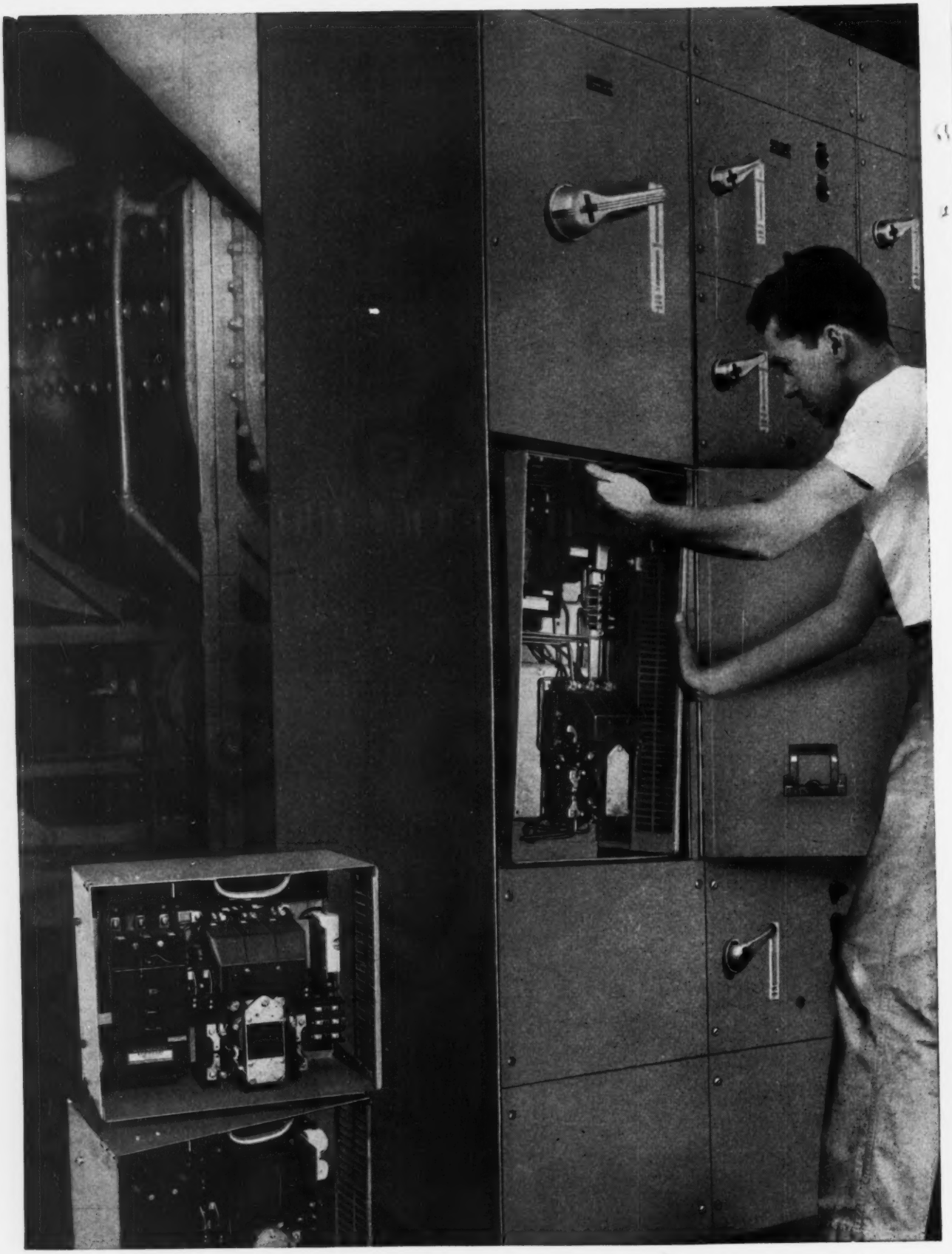
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



For flexibility in production line motor control Hershey uses Westinghouse Control Centers

Changing motor control to meet production line rearrangement is handled with a minimum of down time at Hershey Chocolate Corp. Here, Westinghouse Control Centers offer definite time-savings through complete flexibility in structural units . . . in electrical components.

For instance, starter units are completely interchangeable. Substitution or rearrangement of units is handled easily without creating waste space. Starter units have a standard width and depth; height varies in multiples of 14 inches. Thus a 28″ unit can replace two 14″ units, three 14″ units can replace a 42″ unit, and so on.

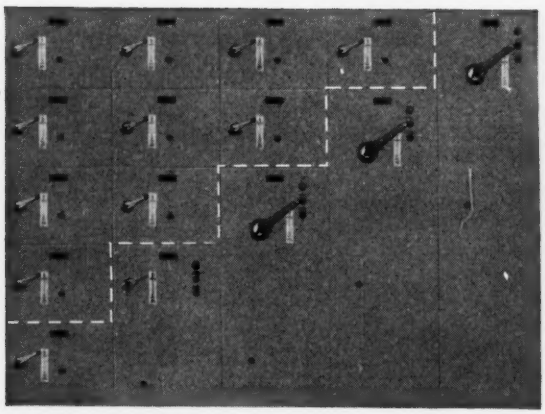
Vertical structures, too, are built to standard dimensions. They are freestanding and allow any arrangement to meet floor plan requirements. Additional structures are added to existing units for extra capacity.

Any combination of control devices needed for motor operation can be housed and co-ordinated in the Westinghouse Control Center. Linestarters in NEMA sizes 1 through 5, reduced voltage starters, circuit breakers, and fusible switches can readily be combined to meet the job.

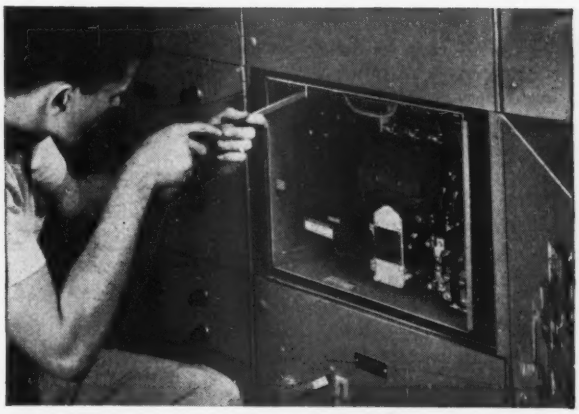
See these advantages now, right on your desk top. Call the local Westinghouse engineer for a demonstration of a scale model Westinghouse Control Center. He can help you, too, in applying control centers in your plant; or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-27033

YOU CAN BE SURE... IF IT'S Westinghouse



Control center starter units are completely interchangeable. They have a standard width and depth; height varies from 14″ to 70″ in multiples of 14″.



With only a screw driver all wiring rearrangement and installation can be done quickly and easily, through front access to all starter components.

Magnet Wire Tester Developed

Only one in the country and capable of handling up to 15 kv in quality control testing of magnet wire used in electrical apparatus, this new dielectric tester was designed and developed by engineers of Anaconda Wire & Cable Co. Despite the high voltages handled, accidental opening of any one of the device's several doors will cut off all voltage immediately. Leonard Baker, laboratory technician at Anaconda's Anderson, Ind., mill, where the tester was installed, here tests magnet wire in around-the-clock production run check of every machine in the mill.

Industrial Parley . . .

. . . for educators will highlight role of America's electrical manufacturing industry

The electrical manufacturing industry will play host to more than 600 high school and teachers college faculty members from across the nation at a meeting of the Industrial Council slated for Oct. 30-31 at Rensselaer Polytechnic Institute, Troy, N. Y. The role of America's electrical manufacturing industry in creating better living at home and providing vital materials for the defense programs of free nations will be examined by the teachers, who specialize in social studies.

Addresses by industry leaders on the increasing importance of the electrical manufacturing industry will be featured and the educators will participate in 18 panel discussion groups dealing with the economic and social growth of the industry. In announcing plans for the meeting, Dr Ray Palmer Baker, vice president of Rensselaer and director of the Industrial Council, said that about 75 authors, editors, and public opinion specialists will also attend.

GE's Lang to Speak . . . Heading the list of industrial guests will be Chester H. Lang, vice president, General Electric Co. Lang is also permanent general chairman of the Industrial Council.

Members of the program committee, under the chairmanship of Robert Paxton, executive vice president, General Electric, include: Allen B. Du Mont, president, Allen B. Du Mont Laboratories, Inc, and Phillip D. Reed, chairman of the board of GE, both ex officio; J. W. Corey, president, Reliance Electric & Engineering Co; C. T. Lawson, vice president, Nash-Kelvinator Corp; Don G. Mitchell, chairman of the board, Sylvania Electric Products, Inc; A. C. Montieth, vice president, Westinghouse Electric Corp; Hoyt Post Steele, executive vice president, Benjamin Electric Manufacturing Co; Robert C. Tait, president, Stromberg Carlson Corp; and William A. Yost, Jr, vice president, Allis-Chalmers Manufacturing Co.

In commenting on the Council, Livingston W. Houston, president of RPI, said "Teachers of social studies have been invited to take part in the Council because of their responsibilities in interpreting the social structure of this country to youth."

MANUFACTURING BRIEFS

Triangle Conduit & Cable Co, Inc, New Brunswick, N. J., manufacturer of electrical wire, cable and conduit, plans to enter the brass and copper tube field. Triangle will manufacture the companion line in its new mill which covers an area of 130,000 sq ft. Production is scheduled to start Oct. 15.

Westinghouse Electric Corp has announced plans to build a multi-million dollar plant near Staunton, Va., to manufacture packaged air-conditioning units. The plant, which will employ more than 500 persons, will be operated by Westinghouse's Air Conditioning Division, Hyde Park, Mass. Completion date of the plant is set for June, 1954.

MANUFACTURERS EARNINGS

Company	Period Months	Ended	Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Four Wheel Drive Auto	12	June	$308,337	$488,939	$1.03	$1.63
General Dynamics	6	June	3,195,000	2,091,000	3.61	2.29
Gould-National Batteries	3	July	684,700	756,199	1.90	2.14
Ingersoll-Rand	6	June	9,873,259	9,876,697	4.88	4.88
Reliance Elec. & Eng	9	July	1,307,965	1,356,747	2.86	2.96

IT'LL PAY YOU TO INVESTIGATE THE

NEW Bantam® Crawler

. . . at the lowest price in the Industry

$9,350

F.O.B. Factory - Basic Crawler with 1400 Lb. Counterweight, less attachment (Price subject to change.)

CAN YOU AFFORD NOT TO OWN A C-35?

Get a "$'s and Sense" On-YOUR-Job Demonstration

ask your Bantam Distributor or write factory now!

5 TON
⅜ Cu. Yd.
MODEL
C-35

Only Bantam gives you these Design Features at $9,350

TWO-SPEED INDEPENDENT TRAVEL ENABLES the operator to move at varying speeds, forward or backward, while operating the front end attachment.

LOW GROUND-BEARING PRESSURE - 2 pad sizes available - 5 lbs. per sq. in. with 16" pads - 3-⅓ lbs. per sq. in. with 24" pads.

BIG MACHINE STABILITY - Longer, wider tracks - and a low center of gravity gives greater lifting capacity.

HIGH SPEED OPERATION features immediate acting straight mechanical controls, easy positive breaking action, fast line and swing speeds.

FAMOUS BANTAM FEATURES - Power boom hoist, machine cut gears, anti-friction bearings, 4 hook rollers, greater visibility.

94-INCH OVER-ALL WIDTH allows the Bantam to be moved from job to job on standard trailers without special highway permits.

Write for FREE

C-35 SPECIFICATIONS BOOKLET
Form C-100

SCHIELD Bantam

COMPANY • 287 PARK ST., WAVERLY, IOWA, U.S.A.

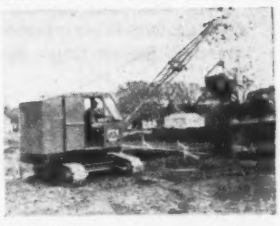
SB-CCR-3

ANOTHER NEW PRODUCT OF THE WORLD'S LARGEST PRODUCER OF TRUCK CRANES AND EXCAVATORS

BACK HOE - Crawler working in heavy mud crawls out after trenching with no trouble. C-35's flotation enables Bantam to work in all kinds of weather under rugged underfoot conditions of muck, mud and sand.

SHOVEL - Handles up to 100 cu. yds. per hour from stockpile . . . up to 90 cu. yds. excavating in average material. Automatic dipper trip means quick, effortless dumping. Also available with ½ cu. yd. rehandling bucket.

DRAGLINE - Digs 90 cu. yds. per hour in average material. Available with perforated or solid buckets. Ideal for gravel pits, ditch cleanout, cutting new drainage ditches, basement excavations, stockpiling, pits, etc.



CLAMSHELL - Ideal for material handling and loading out of stock-pile . . . precision excavating of bell holes, special excavating on pipeline jobs, clean-out of trenches. Handles up to 80 cu. yds. of average bulk material per hour.

When Life's at Stake Rely on...

KLEIN

Show the familiar Klein trademark to the old-timer on the pole and he'll tell you—"that's the equipment I've been using ever since I was a grunt."

Yes, workmen just naturally feel safer when the equipment is Klein—recognized for quality "Since 1857."

ASK YOUR SUPPLIER
Foreign Distributor: International Standard Electric Corp., New York.

Write for your free copy of the Klein Pocket Tool Guide today!

Since 1857

Mathias KLEIN & Sons
3200 BELMONT AVE. CHICAGO 18, ILL.

Georgia Power Co will receive the first transformer to be built and shipped from General Electric Co's new $25 million Rome, Ga., plant, now under construction. The 5,000 kva, three-phase transformer will be installed in the utility's Atlanta Division in the first quarter of 1954.

Baldwin-Lima-Hamilton Corp has laid off 900 workers from its Eddystone (Pa.) Division during the past several weeks and at least 1,000 more will be released by the end of this month. The company attributed layoffs to recent cutbacks in contracts with federal defense agencies.

SALES ASSIGNMENTS

COMPANY STAFFS

Worthington Corp, Harrison, N. J., has appointed L. J. MacKenna district office manager of its Tulsa (Okla.) office. MacKenna, who joined Worthington in 1926, has been associated with the company's New York district sales office for the past 20 years.

General Electric Co's Apparatus (Division) Mid-States district, St. Louis, has named G. Richard Shoemaker acting manager of apparatus product sales and Olle H. Halttunen manager of component product sales. In 1951 Shoemaker was assigned to organize in St. Louis the first marketing research division in any one of the sales offices of the Apparatus Sales Division. Last year Halttunen was made manager of sales of resale industries of the industrial department at St. Louis.

Riley Stoker Corp, Worcester, Mass., has assigned William H. Hardie as sales engineer in its New York office. Hardie has had wide experience in the steam generating equipment field.

Elliott Co, Jeannette, Pa., has appointed the following assistant managers: E. A. Humble, in the Boston office; M. C. Seeman, Cleveland; and O. M. Sievert, Kansas City, Mo. Humble, who was assistant to the firm's general sales manager from 1941 to 1944, joined Elliott in 1925. Seeman, who started with Elliott in 1947, became a field engineer in the Cleveland office in 1948. Sievert, who began with the firm in 1944, went to the Kansas City office in January of this year.

Line Material Co, Milwaukee, has assigned Charles E. Burkett as L-M fibre products sales engineer in its Eastern Division covering the New England and Middle Atlantic states. Burkett, who specializes in bituminous fibre products for the electrical industry, will make his headquarters at Line Material's New York office.

Electric Storage Battery Co, Philadelphia, has named L. M. Gay manager of its Cleveland branch. Gay, formerly manager of Exide's Cincinnati branch, re-

GUARANTEED!

Accurate Weight ...Accurate Length as Marked

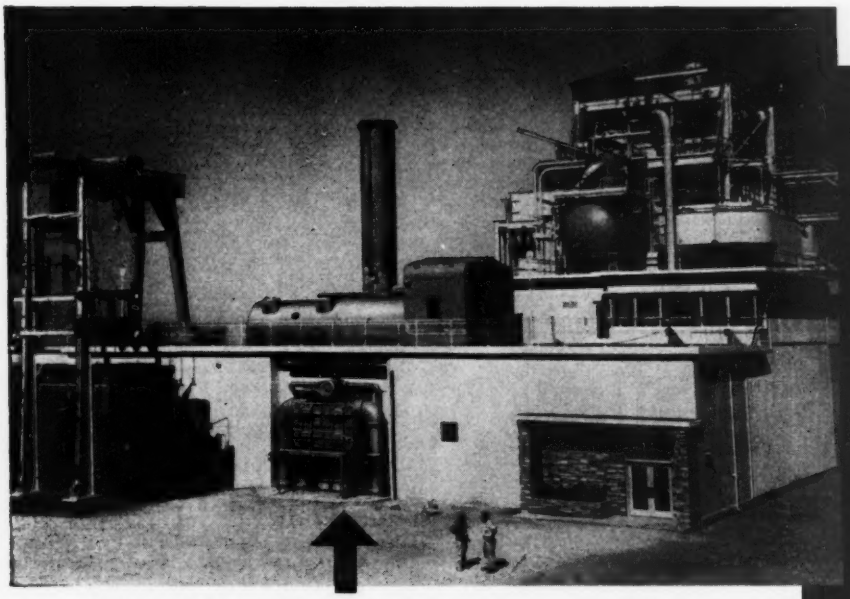
When it's a Haartz-Mason made tape *you know* it's full length . . . full weight. *You know* it's full strength in substance. *You know* its adhesive stays *fresh longer. You know* there's no better tape made than Paramount, Stronghold and Paraplastic . . . because they're Guaranteed.

Haartz-Mason, Inc.
WATERTOWN 72, MASS.

It Pays to Know these brands

All guaranteed accurate length — accurate weight as marked.

Salt River Power District Installs I-R Rectangular Condensers in unique, outdoor-type steam plant



NEW KYRENE POWER PLANT, designed to take advantage of Arizona climate conditions, saves valuable under-turbine space with **Ingersoll-Rand Rectangular Condensers**

This 27,500 sq. ft. I-R Rectangular Condenser serves Unit No. 1, a 30/33,000 kw turbine-generator, at the new Kyrene Steam Plant of the Salt River Power District.

The new Kyrene Steam Plant, near Phoenix, Arizona, is the latest addition to the Salt River Power District's combined steam, hydro and diesel power generating system.

Designed and built by the Bechtel Corporation, the Kyrene Station differs from the conventional outdoor installation in that the maintenance shops and auxiliary equipment are under cover for the comfort and convenience of operating personnel. All other elements of the station are of the outdoor type resulting in maximum economy of construction for the Arizona climate.

Unit No. 1—a 30/33,000 kw turbine-generator with throttle conditions of 850 psig, 900F—is supplied by a 350,000 lb. per hr. steam generator, designed to burn natural gas automatically, fuel oil manually, or coal or lignite on conversion. The turbine is served by an Ingersoll-Rand Rectangular Condenser containing 27,500 sq. ft. of cooling surface. Condenser cooling water is handled by two I-R vertical pumps handling 25,800 gpm. Condensate is handled by I-R vertical pumps.

Unit No. 2, now under construction, will have a rating of 60/66,000 kw. It will be served by a 47,500 sq.ft. I-R Rectangular Condenser, also of two-pass and vertically divided design. The condensate and circulating pumps will again be supplied by Ingersoll-Rand.

These Ingersoll-Rand Condensers save valuable space because their *rectangular design* makes the most efficient use of the rectangular space available below the turbine. And installation cost is minimized because they are completely assembled in the shop, then shipped in large sections, completely flanged for easy erection without any field fitting or strength welding.

Ingersoll-Rand

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COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

DOW CORNING 5 SILICONE COMPOUND

Repels Water
Protects
Lubricates
Insulates

Pole-Top Disconnect Switches

Proved effective as a switch lubricant; also as a release agent to keep switches operable under icing conditions.

Switch Clips, Hinges and Bearings

A mixture of zinc dust with Dow Corning 5 Compound serves as a lubricant and oxidation inhibitor. Zinc dust assures adequate conductivity. One application gives 2 to 3 years' protection.

ASCR Wire Splices

Applied to both the aluminum and steel conductors, compound flows under pressure around the spliced wires to fill voids, improve heat conductivity, exclude moisture and inhibit formation of oxide film.

5 kv Service Entrance Cable

Useful as a filling compound to prevent migration of water along rubber insulated 5 kv service cable when used without potheads.

Dow Corning 5 silicone compound remains stable at temperatures ranging from —70 to 400°F.

***WRITE TODAY* for more information on this compound and on other silicone products that: maintain high surface resistivity on insulators and electronic parts; preserve lineman's protective equipment.**

Address Dept. DN-9

DOW CORNING SILICONES

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

places W. P. Roche, who was granted indefinite leave of absence to regain his health.

Graybar Electric Co, Inc, New York, has named E. L. Harrelson operating manager of the firm's Shreveport (La.) branch. Harrelson is being replaced as operating manager at El Paso, Tex., by H. L. Warman. The company also appointed the following operating managers: H. J. Couch, at Oklahoma City; J. P. Flowers, Allentown, Pa.; and W. R. Malmo, acting operating manager, Denver.

REPRESENTATIVES

Kuhlman Electric Co has named Frederic S. Bacon, Jr, as sales representative for its Transformer Division. Bacon, who will represent the company throughout the New England States, maintains offices at 24 Central St., Winchester, Mass. Kuhlman Electric also appointed Einar Lindstrom as a representative in upper New York State and north central Pennsylvania to handle central station utility accounts. Lindstrom is associated with Lindstrom Electric Co, Syracuse, New York.

Copes-Vulcan Division of Continental Foundry & Machine Co, Erie, Pa., has appointed the following representatives for its products: Power Economy, Inc, Kansas City, Mo.; Hank Thurstin Co, Denver, Colo.; and C. H. Spencer & Co, Salt Lake City, Utah.

MEETINGS CALENDAR

Rocky Mountain Electrical League
50th Annual Fall Convention, Broadmoor Hotel, Colorado Springs, Colo., Sept. 20-23.

National Association of Railroad and Utilities Commissioners
Hotel Roosevelt, New York, Sept 20-26.

Edison Electric Institute
Accident Prevention Committee, Radisson Hotel, Minneapolis, Sept. 21-22; Prime Movers Committee, Detroit, Oct. 5-6; Transmission-Distribution Committee, Hotel Nicollet, Minneapolis, Oct. 8-9; Industrial Relations Committee, Fall Round-Table Conference, Sheraton Hotel, Chicago, Oct. 12-14; Meter-Service Committee, William Penn Hotel, Pittsburgh, Oct. 19-21; Electrical Equipment Committee, Jung Hotel, New Orleans, Nov. 2-3.

Missouri Valley Electric Association
Accounting Conference, President Hotel, Kansas City, Mo., Sept. 21-22; Sales-Rural Conference, President Hotel, Kansas City, Mo., Oct. 7-9.

Instrument Society of America
8th National Instrument Conference-Exhibit, Sherman-Morrison Hotels, Chicago, Sept. 21-25.

International Association of Electrical Inspectors
Silver Jubilee Meeting, Edgewater Beach Hotel, Chicago, Sept. 21-26.

***Pennsylvania Electric Association**
Annual Meeting-Business Conference, Benjamin Franklin Hotel, Philadelphia, Sept. 22-23; Fall Meeting, Relay Committee, Irem Temple Country Club, Dallas, Pa., Oct. 1-2; Joint Meeting of Transmission-Distribution Committee and Electrical Equipment Committee, Abraham Lincoln Hotel, Reading, Pa., Oct. 8-9; Fall Meeting, Meter Committee, Brunswick Hotel, Lancaster, Pa., Oct. 22-23; Fall Meeting, Communications Committee, Hotel Brunswick, Lancaster, Pa., Oct. 29-30; Fall Meeting, Systems Operation Committee, Castleton Hotel, New Castle, Pa., Nov. 5-6.

Electric Lines Club of New England
Fall Meeting, University Club, Boston, Sept. 23.

the New Way to Cut ACSR

Save 15 to 30 minutes per splice

- **HERE IS AN ACSR PRE-SPLICE CUTTING TOOL** that cuts the aluminum strands in seconds—without damaging the supporting steel core. Cutting stops automatically when core is reached.
- **SWIFT, ONE-STROKE ACTION** — replaces the tedious hacksaw method. You get clean edges that help assure a clean splice.
- **TWO STYLES** — Made with hickory handles for cutting hot or cold lines in ACSR sizes from #6 to 4/0. Larger cutters for cables from 266,800 CM to 715,500 CM (max. outside diameter 1.09") are made with forged steel handles.
- **WELL-BALANCED, LIGHTWEIGHT, TESTED** — These tools have the same exclusive features found in Interstate Hot Line Cutters and Bolt Cutters. Simple geared action, with only 4 movable parts. No complicated mechanism. No delicate adjustments.

Write for full data and prices

INTERSTATE DROP FORGE CO.
Special Products Division
4005 N. 27th St. Milwaukee 16, Wis.

Let NELSON build your BENCHBOARDS, CONTROL DESKS and CONTROL CONSOLES

NELSON Piped & Wired Benchboard for electric power plant.

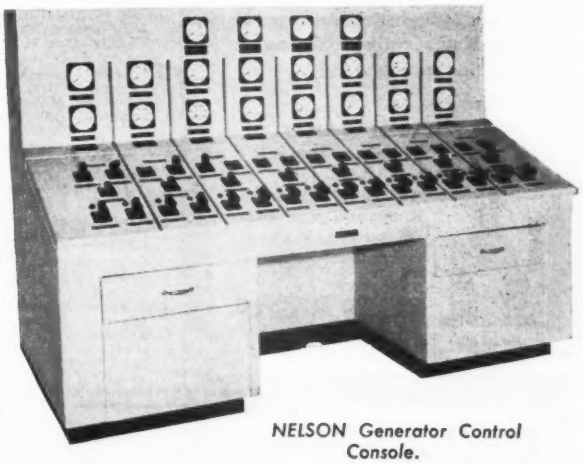
The Nelson Electric Manufacturing Company is admirably qualified to manufacture custom-built control benchboards, control desks and control consoles.

In producing these units we can process steel up to ¼" plate. Mimic bus and other symbols can be applied to the face of the panel. Instrumentation is piped to bulkhead fittings and wired to terminal blocks as required. The assembly is shipped as a completed unit.

We will appreciate the opportunity of quoting on your requirements.

NELSON Control Console.

NELSON Control Desk with switches, push buttons and pilot lights mounted in explosion-proof enclosures.



NELSON Generator Control Console.

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

217 N. DETROIT AVE. TELEPHONE 2-5131

On-the-Job

Cutting

OF POWER CABLE

Made easy

NEW HYDRAULIC

MANCO GUILLOTINE

Bites right through underground primary cable. Accommodates all sizes of cable to 3½" O. D. Fast, portable . . . can be used in any position. Ideal for use in maintenance splicing and renewing cable as well as high speed salvage cutting. Blades available for no deformation cutting to 2½".

Model 30

WIDE VARIETY OF PUMP UNITS

The Guillotine Model 30 is available with manual, compressed air, or electric hydraulic pumps.

MANCO MFG. CO.
BRADLEY, ILL.

SEND COUPON OR WRITE

MANCO MFG. CO., Dept. EW-9-D, Bradley, Ill. Send me information and prices on Guillotine Model 30.

Name.....

Firm.....

Street.....

City.....Zone.....State.....

Public Information Program
West North Central Region, River Inn Hotel, Fergus Falls, Minn., Sept. 24; East North Central Region, Hotel Fort Hayes, Columbus, Ohio, Sept. 25; Mid-Atlantic Region, Lord Baltimore Hotel, Baltimore, Md., Sept. 30; Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

New England Meter Engineers
Fall Meeting, Cascade Lodge, Saco, Me., Sept. 24-25.

American Institute of Electrical Engineers
Middle Eastern District Meeting, Daniel Boone Hotel, Charleston, W. Va., Sept. 29-Oct. 1; Conference on Application of Motors to Air-Moving Equipment and Symposium on Induction Motors, Hotel Van Orman, Fort Wayne, Ind., Oct. 6-8; Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

National Electrical Industries Show
Sponsored by Eastern Electrical Wholesalers' Association, 69th Regiment Armory, New York, Sept. 29-Oct. 2.

Great Lakes Power Club
Plankinton House, Milwaukee, Wis., Oct. 1-2.

Southeastern Electric Exchange
Fall Meeting, Engineering-Operation Section, Carolina Hotel, Pinehurst, N. C., Oct. 1-2; Accounting Conference, Battery Park Hotel, Asheville, N. C., Oct. 15-16; General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 19-21.

Interstate Power Club
Hotel Martinique, New York, Oct. 5; Hotel Martinique, New York, Dec. 7.

American Society of Mechanical Engineers
Fall Meeting, Sheraton Hotel, Rochester, N. Y., Oct. 5-7; Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

Electric League of Western Pennsylvania
4th Industrial Electric Exposition, William Penn Hotel, Pittsburgh, Oct. 6-8.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 7-9.

Association of Edison Illuminating Companies.
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Oct. 8-10.

National Association of Electrical Distributors
Fall Meeting, Pacific Zone, Hotel del Coronado, Coronado, Calif., Oct. 11-14.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Oct. 12-13.

Electrical Association of Philadelphia
Biennial Electric Progress Show sponsored by Manufacturers' Division, Convention Hall, Philadelphia, Oct. 13-15.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

University of Texas
Power Distribution Conference, Department of Electrical Engineering, Lower Colorado River Authority Auditorium, Austin, Oct. 19-21.

Oklahoma Utilities Association
Electric Light and Power Division, Eastern District, Vinita, Okla., Oct. 22; Western District, Norman, Okla., Oct. 23.

National Electrical Manufacturers Association.
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric and Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

Public Utilities Advertising Association
Region Two, Annual Meeting, Skytop, Pa., Dec. 10-11.

*Addition this week.

Simple, low cost way

TO KEEP NUTS TIGHT

Whether you build equipment, or buy equipment, specify PALNUT Lock Nuts to assure tight assemblies for the life of your equipment. Cut down troubles — reduce maintenance — improve operating characteristics.

PALNUT Lock Nuts cost little, apply fast, exert a double locking spring action that prevents nut from loosening and bolt from backing out. Require only 3 bolt threads. Easily removed and re-used when servicing.

Widely used in Utility field

PALNUT Lock Nuts have been used for years on wood pole, steel towers, fittings, connectors, switches, hardware, transformers, etc. Parkerized and hot dip galvanized steel; also silicon bronze. Get Bulletin #577 and samples.

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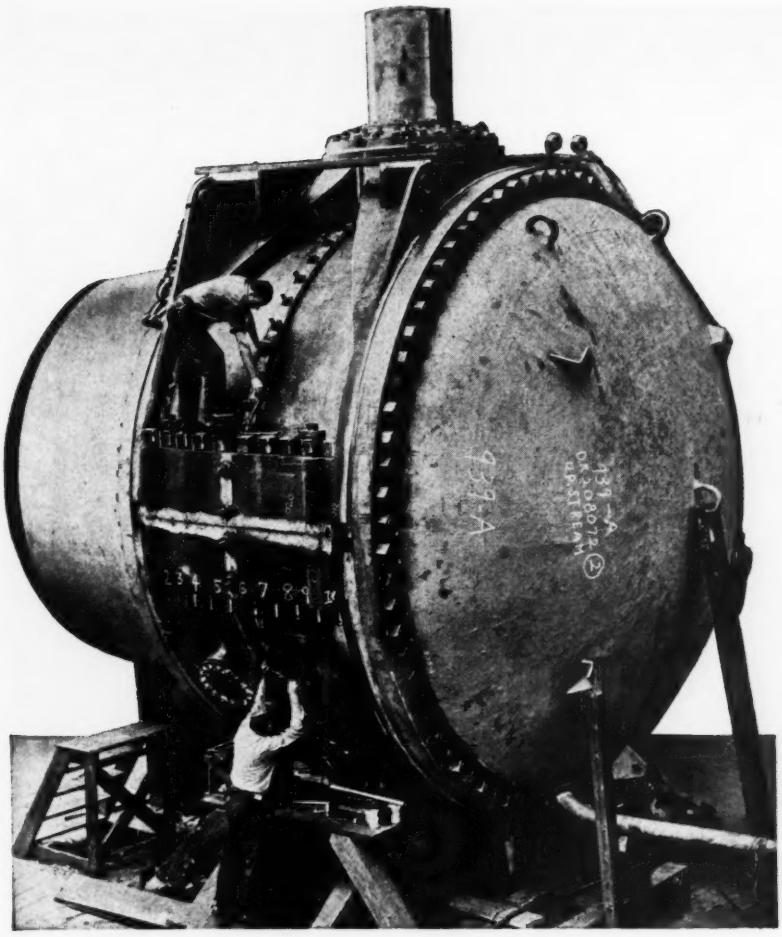
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost



This 16-Foot Butterfly Valve Illustrates the type of work which Newport News takes in stride. Newport News built 3 such valves, each weighing 446,000 lbs., for the Ross Power Plant, Skagit Project, Department of Light, City of Seattle, Washington. Designed for a water flow of 3,620 cu. ft. per sec., and a hydrostatic pressure of 290 psi., these valves were shop tested by Newport News at 450 psi. They are hydraulically operated with oil at 1,500 psi. pressure. Shop tests assure speedy, trouble-free assembly of Newport News built equipment, on the site.

The TEST of a TITAN

Here is one of the largest high head butterfly valves ever built, undergoing a shop test at Newport News. If you had an opportunity to follow this unit from start to finish, you would see *first hand* how Newport News produces massive equipment *economically*. For economy is a basic advantage that results from Newport News' high integration of skill and production facilities.

Large engineering and technical staffs, operating a plant comprising acres of brass, iron and steel foundries, five huge machine shops and other extensive fabricating facilities, have made Newport News one of the world's largest producers of hydraulic turbines, valves, gates, penstocks and other essential equipment... both standard and special in design.

Let us bid on your equipment. Write us today for your copy of *"Water Power Equipment."*

NEWPORT NEWS

SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia

"Hurry, fellows . . . another electric lesson!"

No idle dream, this picture. In communities where power suppliers and Westinghouse have worked together to supply schools with well-planned, easy-to-use and *wanted* teaching aids, the study of electric power has become an intriguing classroom activity.

Working with school authorities from coast to coast, Westinghouse has created an unusually successful kit of teaching materials on electric power. Students like it because it gives them exciting sessions devoted to constructing a model generating station in class, because facts about electric power are presented through interesting cartoon-type booklets. Teachers and administrators welcome the full-color historical wall charts and detailed Teacher's Guide.

Power supplier executives determined to do the best possible community relations job will find a helpful hand at the nearest Westinghouse office . . . plus full details on the Electric Power Kit. That's because of the Westinghouse conviction that, by planning together and furnishing the right kind of materials, we can have still more young Americans eagerly anticipating "another electric lesson!" Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-97177

THE ELECTRIC POWER KIT consists of a model generating station, three full-color wall charts dramatizing the importance of electric power, 40 cartoon-type booklets for student use, and a Teacher's Guide.

YOU CAN BE SURE...IF IT'S Westinghouse

A REPORT FROM THE LABORATORIES OF REMINGTON RAND ON

Electronic developments for business and science

Much of the popular talk about "giant brains" has actually obscured the work which electronic computing systems *are doing now* . . . to answer the pressing problems of business record keeping and control as well as scientific and mathematical computations.

An electronic computer system can process a large volume of data faster and more economically than any other method. Only one operation is required for a complicated program of computing, selecting and filing information. Routine decisions can be made automatically on the basis of instructions given the system. Exceptional conditions requiring management attention can be automatically signaled.

Remington Rand presents here some practical electronic devices which may be applied profitably today by business and science:

High-speed tallying

The electronic storage system is a new Remington Rand development. For John Plain & Co., a large wholesale mail order firm, it produces up-to-the-minute inventory analysis by item under the most demanding conditions of seasonal and shifting demand. Just ten order clerks—working 10-key input systems to a magnetic drum memory—can provide accurate tallies of orders for 12,000 different items; make available complete tallies each day or anytime needed; and accommodate approximately 80,000 order lines per day.

Punched-card computers

New standards of speed and simplicity in punched-card procedures have been set by our new Punched-Card Electronic Computer. This system eliminates many time-consuming operations on other machines . . . produces *complete* cards which are ready for *immediate* tabulation of records and reports.

Big electronic computers

Remington Rand offers two distinct families of computing systems: 1) UNIVAC all-purpose system, designed primarily for business record keeping; 2) ERA 1101, 1102 and 1103 general purpose systems, designed for scientific or mathematical computations.

Solving problems *today!*

Right now, electronic systems are working economically on such practical tasks as – billing and accounting, statistical reports and forecasts, planning studies and scheduling, production and inventory control, payroll and cost accounting records, pricing analyses, engineering design and many data-reduction applications.

Outstanding UNIVAC features are: processing of alphabetical as well as numerical data without special coding and decoding operations; high speed in sorting, collating, and filing as well as computing and decision making; tremendous speed of input and output by magnetic tapes; and built-in circuits for *automatic self-checking*, unique in large-scale data-handling systems.

ERA systems have an enviable record for high speed solutions to complex mathematical problems such as data reduction, systems simulation, planning studies, and control in real time. The new ERA 1103 provides very high internal speed, large storage capacity, and flexibility to surpass other systems of the same character. It also provides versatility of input and output – by teletype tape, magnetic tape, punched cards (80 or 90 columns), line printer, electric typewriter, and oscilloscope.

Custom-made systems

Air traffic control is just one example of the many special purpose electronic-computer systems created by Remington Rand. This high-speed system receives via teletype such flight facts as: departure time, destination, route, fuel load, payload, and other pertinent data. In less than half a second, the system electronically compares the facts on each flight with as many as 2,000 flight plans it has stored in its magnetic-drum memory. It then revises, cancels, or brings the information up to date according to current conditions. The system completes the process by teletyping the required results back to the sending station . . . without human handling.

System designing

Remington Rand specialists analyze *your* needs in scheduling, process control, machine control, inventory control, data reduction, automatic filing, or other problems. A system may be created for you from standardized "building block" components, or we can design and make special components to your needs.

Computing services

Through two electronic-computing centers, Remington Rand offers you the advantages of the UNIVAC and the ERA systems on a service-bureau basis. The centers have solved problems of such diverse types as complex accounting and record keeping, involved statistical and personnel studies, and cross-indexing of complex catalogs, books, and timetables.

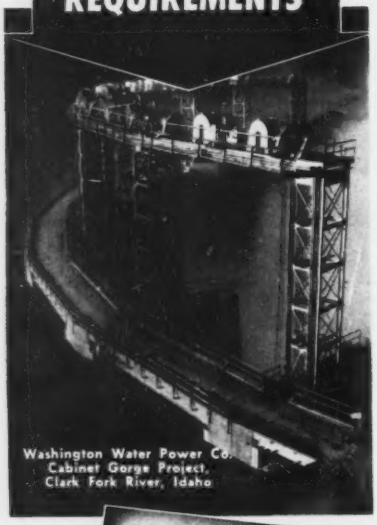
One of the recent jobs handled by the UNIVAC center was a study of seasonal sales patterns and advertising timing. The Bureau of Advertising wanted a projection of 1954 monthly buying trends for 28 specific lines of merchandise in stores across the nation. To do the calculations on this series of 336 trend lines with desk calculators would have taken about 200 man-hours. The UNIVAC computer made all the calculations in just 3 and ½ minutes.

Let us show you how to save time and money on one-time jobs, deadline jobs, unusual jobs, even routine jobs.

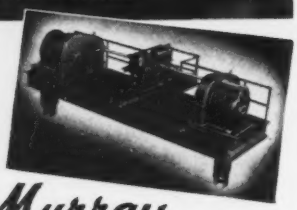
Management seminars

Through seminars and training courses, Remington Rand will help you learn how to apply electronic methods to your needs. In this way your organization can determine the computer system needed—and the economic considerations involved, including choice between our rental or purchase plans. We will also train your employees to operate the system efficiently. For more information, write to Remington Rand Inc., Electronic Computer Dept., Room 1174, 315 Fourth Ave., New York 10.

DESIGNED AND BUILT *to meet all* REQUIREMENTS



Washington Water Power Co.
Cabinet Gorge Project,
Clark Fork River, Idaho



Murray GATES *and* GATE HOISTS *for any Size Power Dam*

MURRAY GATE HOISTS are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

In over 50 years of designing and building gate hoists, we have developed designs for many gate hoist problems. We may have designs and patterns to fit your special requirements. In planning gates or gate hoists, we suggest you write us before your over-all plans are complete . . . it may save time and money. We also build gate hoists to fit your plans and specifications.

HURCO

Write for complete information and Engineering Department recommendations.

D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883
WAUSAU · WISCONSIN

TECHNICAL LITERATURE

NEMA Rectifier and Electrode Identification Standards: National Electrical Manufacturers Association announces the publication of the following standards:—
224-1953 Industrial Rectifier Units for Ungrounded Two-Wire Service (Pumped Type) 225-1953 Electrochemical Rectifier Units (750 volts and less-d-c, Pumped Type) 226-1953 Electrochemical Rectifier Units (750 volt and less-d-c, Sealed Tube Type) EW2-1953 Arc-Welding Electrode Identification
The Rectifier standards are available at $1.75 each, and the Electrode Identification at $0.70 each, by writing the Association at 155 East 44th St., New York 17, N. Y.

High Temperature Bolting & Fastening—Bulletin HTA has been announced by H. M. Harper Co, Morton Grove, Illinois. This 16-page manual is believed to be the first on the subject of extremely high temperature alloys as applied to bolts, nuts, screws and other fastenings. Alloys such as Refractaloy, Discaloy, Inconel, Hastelloy, A-286, and Titanium are covered by tables of mechanical properties and chemical composition. A copy is available by addressing as above.

New Viscosity Standard Adopted—Effective July 1, 1953, the value of 0.01002 poise for the absolute viscosity of water at 20 C, was adopted by National Bureau of Standards as the primary standard for the calibration of standard viscosity samples and viscometers. The ASTM, the National Physical Laboratory in England and the Physikalisch-Technischen Bundesanstalt in Germany have indicated they will also adopt the new value on the same date. The use of the new value of 0.01002 will result in a reduction of 0.3% in the measured value of viscosity. Viscosities reported in absolute units will be correspondingly more accurate. Previously published data based upon 0.01005 poise may be adjusted to the new standard by reducing the published values by 0.3 percent. For details concerning the new value, see The Absolute Viscosity of Water at 20 C, by J. F. Swindells, J. R. Coe, and T. B. Godfrey, J. Research NBS 48 (Jan 1952) RP2279; also see NBS Tech. News Bull. 36, 3 (Jan 1952)

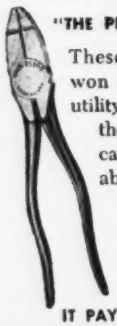
TVA-FONTANA DAM—Publication of Technical Monograph No. 69, *"Measurements of the Structural Behavior at Fontana Dam"*, has been announced by the Tennessee Valley Authority. The report with appendixes is 332 pages and contains 159 illustrations and 26 tables. Coverage includes measurements of settlement, uplift and pore pressures, temperature, deflection, joint openings, strains and stresses, and stresses near surfaces of the dam. Also included are data on Foundation Rock and Concrete, Schedule of Measured Concrete Temperatures, Load and Temperature Deflection, Analysis of Temperature Stress Effect, Automatic Surface Temperature Measurements at Powerhouse, Improved Pore Pressure Installation, Concrete Placing Temperature and Sequence, Temperature Behavior of No-Stress Cylinders, and Temperature Calculations. The report is available at $4.75 from The Treasurer, Tennessee Valley Authority, Knoxville, Tennessee.

VOLTAGE DROP TABLES—United States Rubber Company has released their 24-page permanent reference book titled *"Tables for the determination of Voltage Drop in Copper and Aluminum Conductors."* Limited quantities are available at no charge to engineers, estimators, contractors, industrial electrical engineers and others by writing United States Rubber Co, Public Relations Dept, 1230 Ave of the Americas, New York 20, N. Y.

RUBBER HANDLES

. . . available on the famous UTICA® LUBRING® PLIERS

These heavy, black vulcanized rubber handles are a wonderful addition to the great LUBRING lineman's pliers. They are designed to add extra comfort, long wear and protection—and are available on many UTICA models.



"THE PLIERS THAT OIL THEMSELVES"

These fine LUBRING pliers have won a wide acceptance among utility people as "the pliers that oil themselves". Porous iron lubricating ring "floats" in the joint, absorbs lubricant and feeds it as needed. Keeps joint smooth and free working.

The LUBRING *feature is available in 9 other useful models.*

IT PAYS TO USE QUALITY TOOLS
and the world's best tools are made in U.S.A.

UTICA® DROP FORGE AND TOOL CORPORATION

In Canada
ADLAM TOOL & SUPPLY CO., LTD., MONTREAL

In Fifty Countries . . .

BALDWIN TURBINES develop over 10,000,000 h.p.

No matter what your power plant requirements might be, there are four important reasons why you should turn to Baldwin for the answer to your hydro-electric development problems:

1. Baldwin-Lima-Hamilton Corporation has at its disposal a wealth of experience dating back to the early days of the Pelton Water Wheel Co., a present Baldwin subsidiary, and the I. P. Morris Co. which manufactured its first turbine equipment in 1841.
2. They offer you a complete range of available capacities . . . small, fractional horse power water wheels to the largest units that can be shipped.
3. Since their line includes all four basic types of turbines (at left), Baldwin engineers can make an unbiased recommendation of the type best suited for your conditions and needs.
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You'll enjoy and profit from reading Baldwin Bulletin 1000 which devotes all 24 pages to pictures and data on typical Baldwin turbine installations. Please write to Dept. 5007, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

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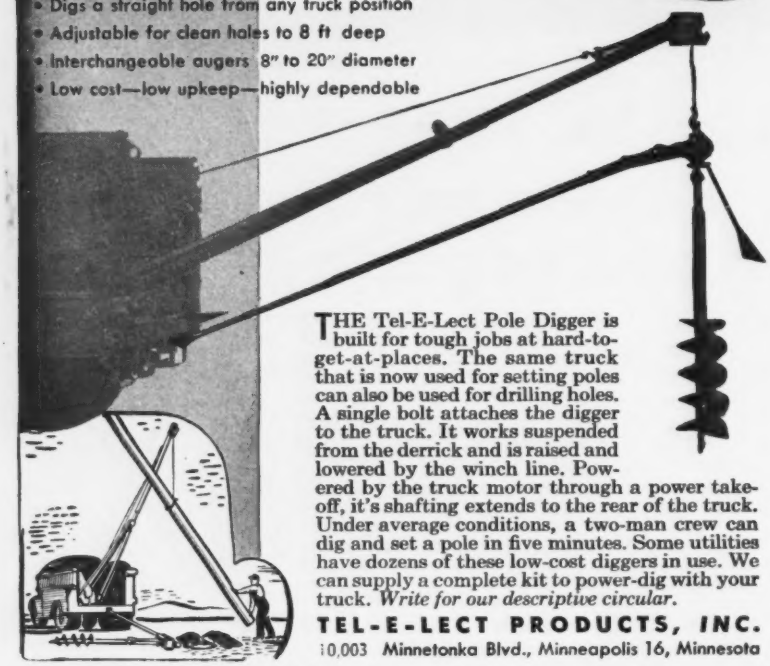

THE Tel-E-Lect Pole Digger is built for tough jobs at hard-to-get-at-places. The same truck that is now used for setting poles can also be used for drilling holes. A single bolt attaches the digger to the truck. It works suspended from the derrick and is raised and lowered by the winch line. Powered by the truck motor through a power take-off, it's shafting extends to the rear of the truck. Under average conditions, a two-man crew can dig and set a pole in five minutes. Some utilities have dozens of these low-cost diggers in use. We can supply a complete kit to power-dig with your truck. *Write for our descriptive circular.*

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Refrigeration Manual—The Trane Company, La Crosse, Wisconsin has announced the publication of the Trane Refrigeration Manual. This latest edition is the ninth printing, 125 pages, on the installation, maintenance and service of refrigeration equipment used in conjunction with air conditioning systems. Chapters have been added on refrigeration piping systems, system control, service operation, and service analysis. Edited for contractors and servicemen, the manual has also been used as an educational text and reference on refrigeration by colleges and industrials. The manual may be purchased at $1.50 by addressing the above.

Trade and Technical Book Service—The formation of Tradebooks of Connecticut has been announced by Mr. Ray Jarmak. The firm is organized to supply trade and technical books, and will maintain a free service to locate hard-to-find technical books. Immediately available at publishers prices are books on tools, dies, jigs, aircraft, chemistery, plastics, electronics, physics, radar, automotive, radio, telecraft, chemistry, plastics, electronics, mathematics, machine design, electricity, pattern-making and forgings. Address communications to Tradebooks of Connecticut, 477 Winthrop Ave, New Haven, 11, Conn.

Electric Power for Iron Ore Projects—Westinghouse has announced its 20-page booklet, B-5858 on the application of electric power to iron ore beneficiation projects. Each step in mining and processing the ore from pit operations through transportation, milling and concentrating, townsite planning, and power generation and distribution is covered. Write to Westinghouse Electric, Box 2099, Pittsburgh 30, Pa.

Data Card on New Code Stress Values—Tubular Products Div, Babcock & Wilcox Co, Beaver Falls, Pa, has announced a new data card showing maximum allowable stress values for ferrous pipe and tubing. The data presented is adapted from Table P-7 of the new ASME Boiler Code. The presentation of this data, with notes and applicable formulae, is designed for convenience in calculating maximum allowable working pressures of tubular equipment at elevated temperatures and pressures. Write for TDC-154, at no charge, to the above, attention Sales Dept.

Symposium on Conditioning and Weathering—ASTM Committee E-1 has sponsored this 104-page symposium which in addition to fundamentals of atmospheric elements and weathering studies, presents separate papers on air conditioning for the manufacture and testing of textiles, paper, adhesives and plastics. Contributors of papers include personnel of U. S. Weather Bureau, Parkes-Cramer Co., Titanium Pigment Corp., N. B. S., National Lead, Carrier Corp., Squier Signal Lab., Bell Tel. Lab., and Devoe & Raynolds. Copies at $2.25 each may be obtained by writing to American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

High Pressure, Wide Temperature Range Lubricant—The Alpha Corporation, Greenwich, Conn., has announced its paper under the title "Properties and Uses of Pure Molybdenum Disulphide As a Lubricant". Author Alfred Sonntag, president of Alpha Corp, presented this paper at the March 1953 meeting of American Society of Lubrication Engineers. It is considered a "first" on the subject. The paper details chemical and physical properties of the lubricant, which includes increasing effectiveness up to 400,000 psi, and temperature stability at −90 to 750 F in air, and up to 2400 F in argon gas. Reprints are available at no charge by addressing the above.

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PHILADELPHIA INDUSTRIAL HIGHWAY: REFRACTOR LUMINAIRES using E-H1 mercury lamps, 100' staggered, Mtg. Ht. 33'.

Top Photo: Courtesy of Georgia Power Company.

Center Photo: Courtesy of Westinghouse Electric Corporation.

Bottom Photo: Courtesy of General Electric Company.

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- PHILADELPHIA INDUSTRIAL HIGHWAY
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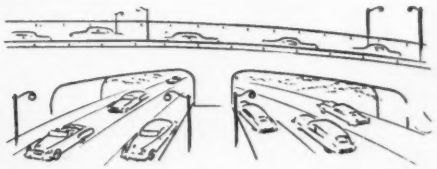

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CATALOGS • BULLETINS

HOSPITAL SURGICAL ROOMS: As an aid to installing or maintaining proper electrical service in hospital surgical and operating centers, Bulletin No 2589, "Explosion-proof Condulet Electrical Equipment for Hospital Operating Rooms," has been announced. The 28-page bulletin describes wiring devices, installation methods and types of explosion-proof condulets for use in protecting electrical outlets, switches and other fixtures from the explosive effects of anaesthetics. Write Crouse-Hinds Co, Wolf and Seventh North Sts, Syracuse 10, N. Y.

ALUMINUM STREET POLES: Aluminum Poles for Street Lighting, Bulletin GEC-695B, 12-pages, completely covers all types. Luminaries for traffic arteries or residential streets are also included. For detail on luminaries with mercury or filament lamps, also ask for pub. GEC-967, from General Electric Co, Schenectady 5, N. Y.

FEED PUMP RECIRCULATOR: Bulletin No. S-53 covers control systems for protecting high capacity centrifugal feed pumps during low load conditions. Electric and pneumatic systems are discussed in the 12 page release obtainable from Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill.

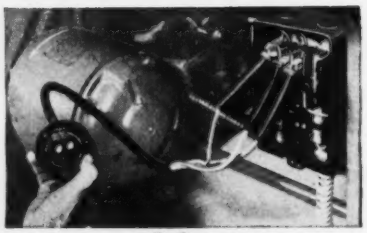
METAL BUILDING INSULATION: Form F-9 has been issued on the blanket form of superfine fiber glass for use as both insulation and noise control medium. A one inch x one square foot piece weighs only one ounce. Vapor barriers are also available with the blanket material. Write Libbey-Owens-Ford Glass Co, Nicholas Building, Toledo 3, Ohio.

MODERN RANCH HOUSE LIGHTING FIXTURES: New beauty and new variety in lighting fixtures for the ultra-modern ranch style home are pictured in Form M-3294. Polished brass, porcelain white and black frames are offered in unique designs with the new GLO-MARK translucent plastics. Write any Markel representative or to Markel Electric Products, Inc, Buffalo 3, N. Y.

ELECTRICAL MEASURING AND TESTING EQUIPMENT: Fully illustrated catalogue GEC-1016A, 64 pages, covers products ranging from simple current indicators to automatic oscillographs, mass spectrometers, and radiation monitors. Write to General Electric Co, Schenectady 5, N. Y.

● **REWIRING SALES KIT:** A 16-page brochure titled "Full Power Ahead" contains everything contractors need to promote business in home rewiring, farm rewiring, and industrial and commercial rewiring. Methods for cooperative efforts of contractors, distributors and utility companies to promote rewiring business are also included. Obtain from Anaconda Wire & Cable Co, 25 Broadway, New York 4, N. Y.

● **MAINTENANCE & REPAIR SHOP BENCHES:** Catalog No. 653 features a complete line of benches with laminated wood tops, smooth steel tops, and all-steel machine stands, tote boxes and welding stands. Construction, size, styles and other data are included. The catalog may be obtained from Industrial Bench & Equipment Manufacturing Co, 98 South St, New Britain, Conn. The catalog replaces the old New Britain bench line, which was recently acquired by Industrial Bench & Equipment.



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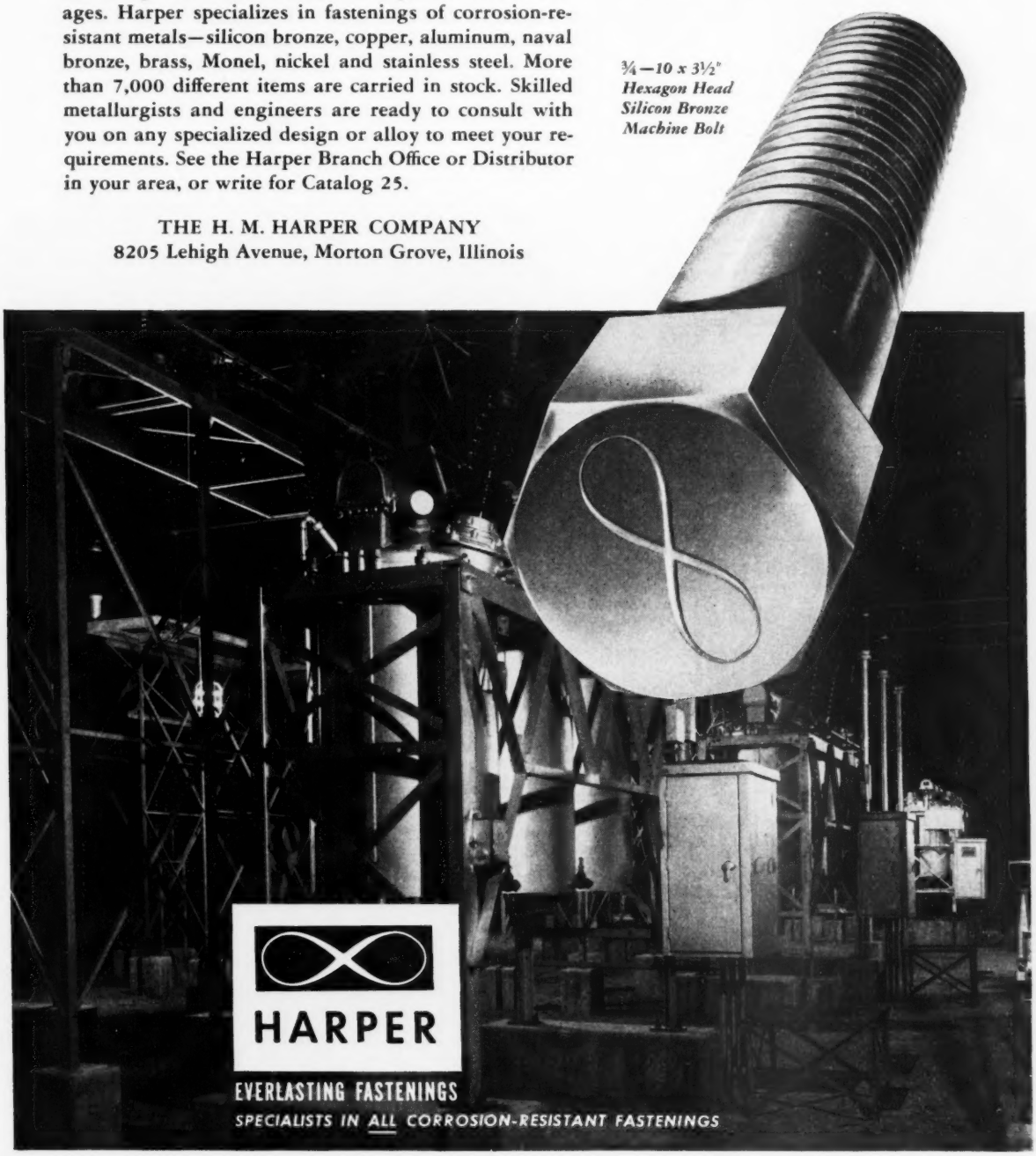

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Measures resistances from ½ to 750,000 microhms

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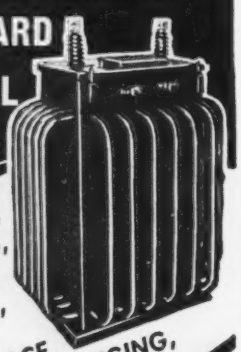

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● **VACU-BREAK PANELBOARDS:** Bulletin VP-450, 12 pages, contains complete descriptive material, dimensional data, horsepower ratings and other pertinent information on the panelboards with the arc-snuffing Vacu-Break switches, and the compact 2½-in sliding contact units. Write Bulldog Electric Products Co, Detroit 32, Mich.

● **PACKAGED WATER CONDITIONING PLANTS:** Bulletin No. 3869 lists component parts, principles of operation, ratings, and dimensions of water conditioners with capacities of 500 GPH to 3,300 GPH. The self-contained units are designed to chlorinate, coagulate, clarify, filter, neutralize, de-alkalize and soften raw water. Write to The Permutit Co, 330 West 42nd. St, New York 36, N. Y.

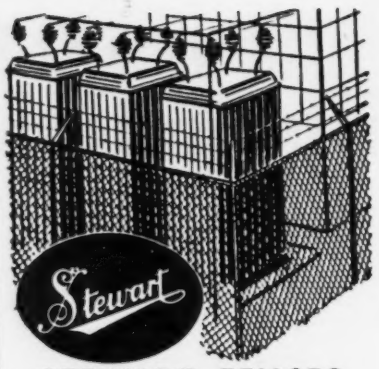
● **FARMERS GUIDE TO ELECTRICAL CONTROLS FOR FARM EQUIPMENT:** A 14-page booklet on time controls for electrical farm equipment has been issued for the purpose of helping farmers and farm engineers save work, time and money. Time controls for poultry, dairy, hog, and general farms, and for greenhouses and farm homes are described and explained in the booklet. Ask for B-TS-100 from Paragon Electric Co, Two Rivers, Wisconsin.

● **ARCWELDING MACHINES:** Catalog 1340 covers over twenty models of AC, DC and Inert-Gas arcwelders. Also included are accessories and electrodes required for special jobs. DC motor-generator, engine-driven sets, DC selenium rectifiers, AC units specifically developed for Heliwelding applications, AC transformer welders, various types of running gear, foot controls, and an automatic arcwelding head. For single copies write to Air Reduction Sales Co, 60 East 42nd St., New York 17, N. Y.

● **POCKET PYROMETER:** Quick and accurate measurement of surface and subsurface temperatures can be made with the Cybertronic Model 240-T pocket pyrometer described in bulletin of the same number. Temperature ranges are 0-600, -1000, -1500, -2000, -2500 F. A 24-in. flexible cable connects the direct reading pyrometer with various types of thermocouples for sub-surface, and revolving or stationary surface temperature measurement. Other models, for high temperature, are protected with glass fabric and 6-in. ceramic tube. Write to Cybertronic Corp of America, 136 8th St, Upland, Chester, Pa.

ELECTRICAL INSULATION PRICE CATALOG: Announcement has been made of a new 140-page catalog on standard put-ups, terms, and aggregation policies pertaining to insulation and including prices on material such as cords and twines, untreated woven tapes, sleevings and tubings, paper and paper products, slot wedges, reinforced or laminated plastics, vulcanized fibre, plastic or resinous films, pressure-sensitive tapes, varnishes and compounds, mica products, varnished fabrics and paper combinations, and other materials. The catalog is available without charge by writing the Publications Dep't, Insulation Manufacturers Corp., 565 W. Washington Blvd, Chicago 6, Ill.

HAND TACHOMETERS: Bulletin 31-P8 describes the measurement of speed of rotating shafts by resonance or vibration without touching the shaft itself. Totally enclosed motors and other machines need not be disassembled to obtain a quick and accurate check of their rpm. This is done with the resonance phenomenon of tuned steel reeds mounted with and calibrated to direct reading scales. Available ranges are 900 up to 100,000 rpm. Other types of tachometers are also included in this bulletin available from James G. Biddle Co, 1316 Arch St., Philadelphia 7, Pa.



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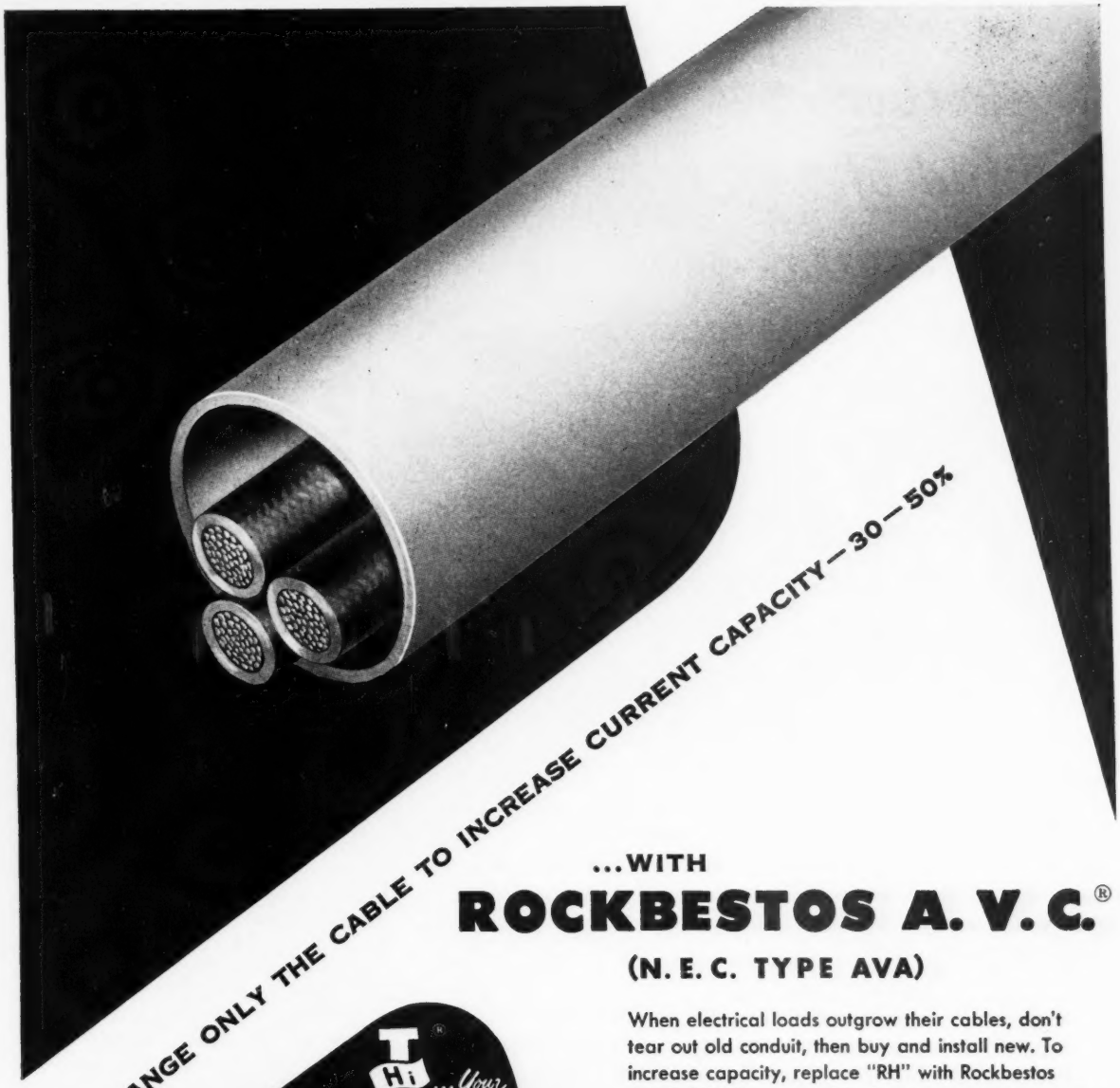

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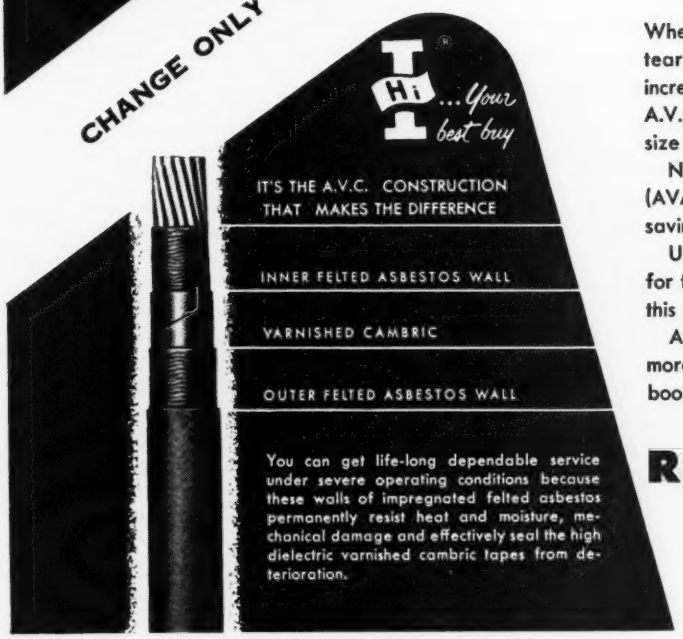
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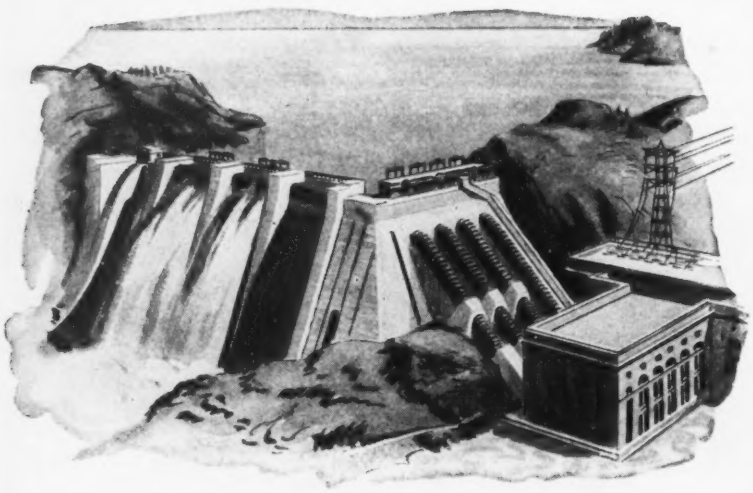

There is another kind of reservoir serving the utilities besides that which is behind a hydroelectric dam. It is the great financial reservoir provided by banking. It is not related to water levels but is full and ready for any practical demand that may be made on it.

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First Rate Boost . . .

. . . in its history will be asked by Public Service Co of Colorado to meet increased costs

Public Service Co of Colorado will apply soon to the State Public Utilities Commission for the first increase in electricity rates in its history.

The company said it would seek a "substantial" raise, which it hopes to put into effect on or before next March 1. The increases are needed, said President John E. Loiseau, to meet higher taxes, increased operating costs and the effects of inflation.

An application to the Federal Power Commission (Sept. 2) by the Colorado Interstate Gas Co, for a 23% increase in the price of natural gas it wholesales to Public Service was "the straw that broke the camel's back," Loiseau said.

Several Reasons Cited . . . However, that only represents a portion of Public Service's need for higher rates in Colorado, Loiseau added. He noted that the company's electric operations have been "marginal" for the last three years and that negotiations for another wage increase for workers now are in progress. Also, he said, the Colorado Tax Commission has just increased the utility tax load.

He said Public Service is investing a net of $16 million per year in expanding its Colorado facilities and should have a minimum return on that of $1 million. But for three years, the net return has been increasing only $300,000 to $500,000 despite new investments, he said.

He emphasized that in 1945 and 1947, Public Service Co reduced its gas and electric rates by 25 and 12½%. He said he did not think—at this time—that the new increase his company will be forced to seek would wipe out those reductions.

Loiseau emphasized that Public Service may oppose the Colorado Interstate Gas Co application before the FPC. Interstate asked an overall increase of about 35%, applying also to Chicago wholesalers. Loiseau said Public Service would enter a protest if the proposed Interstate increase is not fully warranted and justified by the sharply increasing costs but would support the Interstate application if it is justified.

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plugs 'em quick and tight

DUXSEAL is a non-hardening adhesive plastic compound made with an asbestos base. It is the ideal general utility sealing and caulking compound for duct openings, potheads, bushings, terminal boxes, and for filling multi-wire contact boxes indoors. Use it like putty, just as it comes from the handy package, for smooth, workmanlike jobs.

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... Simplifies wiring layout

... Conserves panel space

... One-point, multiple control

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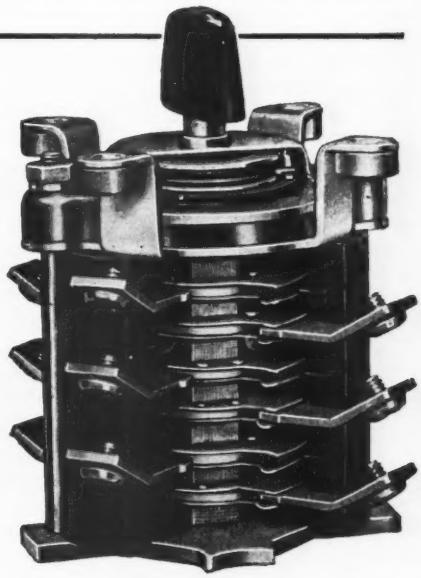

In all ESCO rotary switches, the make and break actions occur inside the insulating phenolic housings of the separate switch sections. These sections are ganged to provide the required number of poles.

Advantages: ESCO rotary switches combine great versatility of application with simplicity and ruggedness of design. In each individual switch section, a variety of rotor shapes and positions is possible. By ganging the required number of such sections, an almost unlimited choice of connection and operating sequence arrangements is available.

Ratings: The Type-JR rotary switch is rated at 10 amperes, 125 volts AC, or 5 amperes, 125 volts DC. The Type-P rotary switch — a high-speed snap-action switch — is available in these same ratings, and also in heavier designs for 30, 60, 100, or 200 amperes at 500 volts AC or 250 volts DC.

ESCO rotary switches can be furnished to meet the latest revised specifications of the Navy Department.

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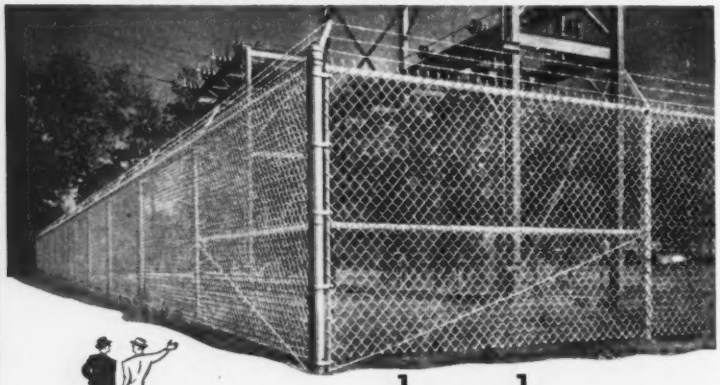

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Energy Use Record Set in NYC During Hot Spell

The recent heat wave caused New York City to set a new record for electricity consumed in one week.

Consolidated Edison Co of New York, Inc, has reported that distribution of electricity for the week ended Sept. 6 amounted to 284,600,000 kwhr—an all-time record and an increase of 20% over the 237,100,000 kwhr for the corresponding week in 1952.

This marks the first time Con Edison has set a new record during a summer week. Usually the maximum is established in the winter. Con Edison's last all-time peak was recorded in the week ended Jan. 11, 1953, when distribution reached 281,927,000 kwhr. Con Edison said there was no single hour during the heat wave when demand surpassed the winter peak level.

Con Edison engineers attributed the record to increased use of air conditioning, overworked refrigerators, and night burning of lights and operation of television sets by sleepless New Yorkers trying to pass the sweltering time. However, load was more evenly distributed over the day than is usual in winter when it peaks at the start of business and late in the afternoon.

Water, Energy Problems Resources Parley Topics

Water and energy resource problems are among the eight major topics scheduled for discussion at the Mid-Century Conference on Resources for the Future to be held Dec. 2-4 in Washington, D. C.

Other areas of discussion include problems of resources research, util-

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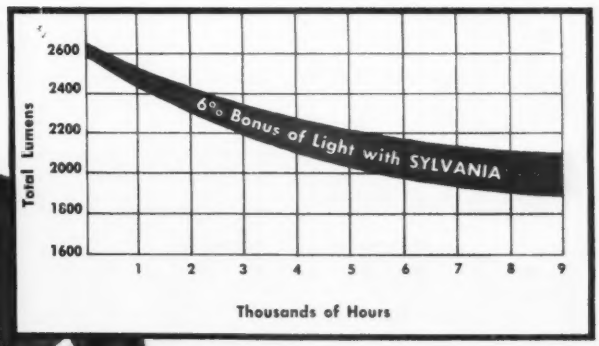

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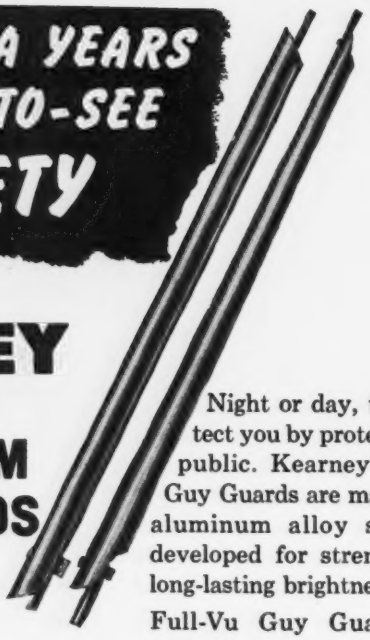

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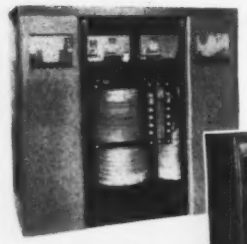

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WRITE FOR DETAILS

A NAME SYNONYMOUS WITH EXPERIENCE

ization of land resources, world supply and availability, and patterns of cooperation.

A steering committee of 16 persons has been named by Conference Chairman Lewis W. Douglas. The committee members represent the many groups actively concerned with natural resources. Among them is A. C. Spurr, president of Monongahela Power Co.

Dr R. G. Gustavson, president of Resources for the Future, Inc, the organization which called the parley, recently issued a statement declaring that the conference will not endorse programs or seek to come forward with a program of its own. He declared, "The great contributions of this mid-century meeting can be to lay the groundwork for the adoption by others, in both public and private undertakings, of policies and programs which will safeguard and promote the national interest now and for later generations."

Industry groups are cooperating in presentation of background material as aids to conference discussion, Norvell W. Page, conference director announced. In addition reports on the resources position of the federal government such as those of the Paley Commission, the Cooke Commission, and some of the reports of the Hoover Commission, will be considered as background material by the conference.

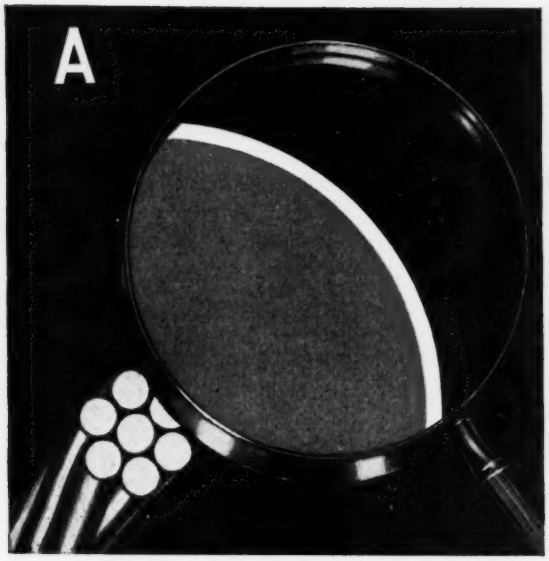
Resources for the Future has received a grant from the Ford Foundation for conducting the Mid-Century Conference.

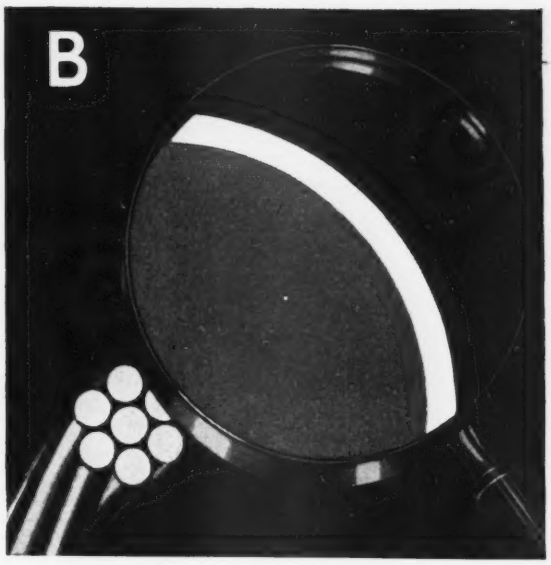
Cheyenne Utility Workers End 7-Week Walkout

A seven-week-long Cheyenne, Wyo., power strike ended early this month and employees of Cheyenne Light, Fuel & Power Co have returned to their jobs.

Representatives of Local 1489, International Brotherhood of Electrical Workers, AFL, and company officials signed a new contract Sept. 5 ending a strike which had idled 102 employees, stalemated new installation of gas and electric facilities, and cut service to a bare minimum since July 17.

The new contract gives the employees pay increases of 10¢ an hour plus several other benefits.





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Where should each be used?

Let's put it this way. The A coating (equivalent in weight to extra-galvanized) certainly has its place; for instance, in cases where it will last as long as the other line components. But where pole structures and other items are designed for the longer-term jobs, then a strand with the thicker B coating is more feasible. *In other words, for greatest overall economy, match the life of the strand to that of the line as a whole.*

As a matter of fact, Bethanized strand comes with a still-heavier coating—called C—for extreme conditions. Thus it is virtually always possible to buy strand that will match the life expectancy of poles, towers, and other structural units.

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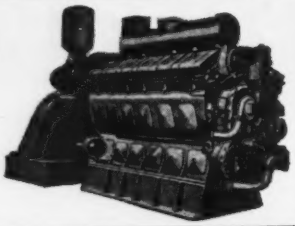

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1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1060	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	S-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-S	600	720	60	General Motors	6-71	90	1200
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1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60
1	200	Whse.	Non-Cond. 125/150# ISP 5/10# B.P., 240/480 v-3-60

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Qu.	Kva	Make	Cycles	Voltages
1	12500	Whse.	25/60	13200 x 13200
1	3750	G.E.	25/60	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	3000(3U)	G.E.	514	600	4000/13200
2	2000	G.E.	450	250	2400
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	666 25 cy.	11000
2	1750	G.E.	514	250	2400
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1500	G.E.	600	600	2300/4150
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

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KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—1250	G.E.	HVDDJ		6600/550
4—1000	Mol.	O	1	44000 x 2300/4160
3—1000	G.E.	HVDDJ	1	2200/480

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TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
4	500	Pitts.	66000/33000—13200/23000 Y
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	200	Pitts.	66000—2300
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
4	5000	G. E.	40935/70900 Y—14500
3	5000	G. E.	38100/66000—6600
3	3333	G. E.	33000/11000—2400/7200
4	500	G. E.	33000—7200/12470 Y
4	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
1	100	West.	33000—240/480 NEW
3	75	Wag.	33000—7200/12470 Y
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000 Y—13280/23000
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	5000	Pitts.	13200—4600, 3 ph.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	West.	13800—480/240
3	250	Pitts.	7200—220/440
3	100	G. E.	7200—240/480
3	75	G. E.	7200—240/480
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	400	G. E.	2400/4160 Y—480
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
3	75	A. C.	2400—240/480
6	50	West.	2400—114/228 DRY TYPE

INDUCT REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
2— 83 KVA West. 200 A. 2400 V. 3 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

4—800 A. 132 KV West. G-222A-2500
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

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2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13280V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2480-220 sec.
3— 200 KVA G.E., 1 Ph., 13280V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V, 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

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1—1000 KW Whse., 600 V. 720 RPM, 4800 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4800 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4800 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4800V. Syn.
1— 150 KW G.E., 126/250V. 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

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2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West., CW. 600 RPM, 440V.
1— 200 H.P., West., CW. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM. 2300V., 3PH, 60 Cy.

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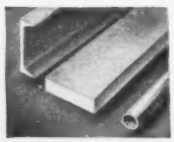
Alcoa Aluminum Bus Conductors are available in rectangular bars, solid round bars, channels and tubular shapes.



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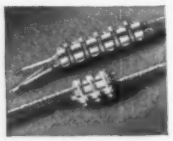

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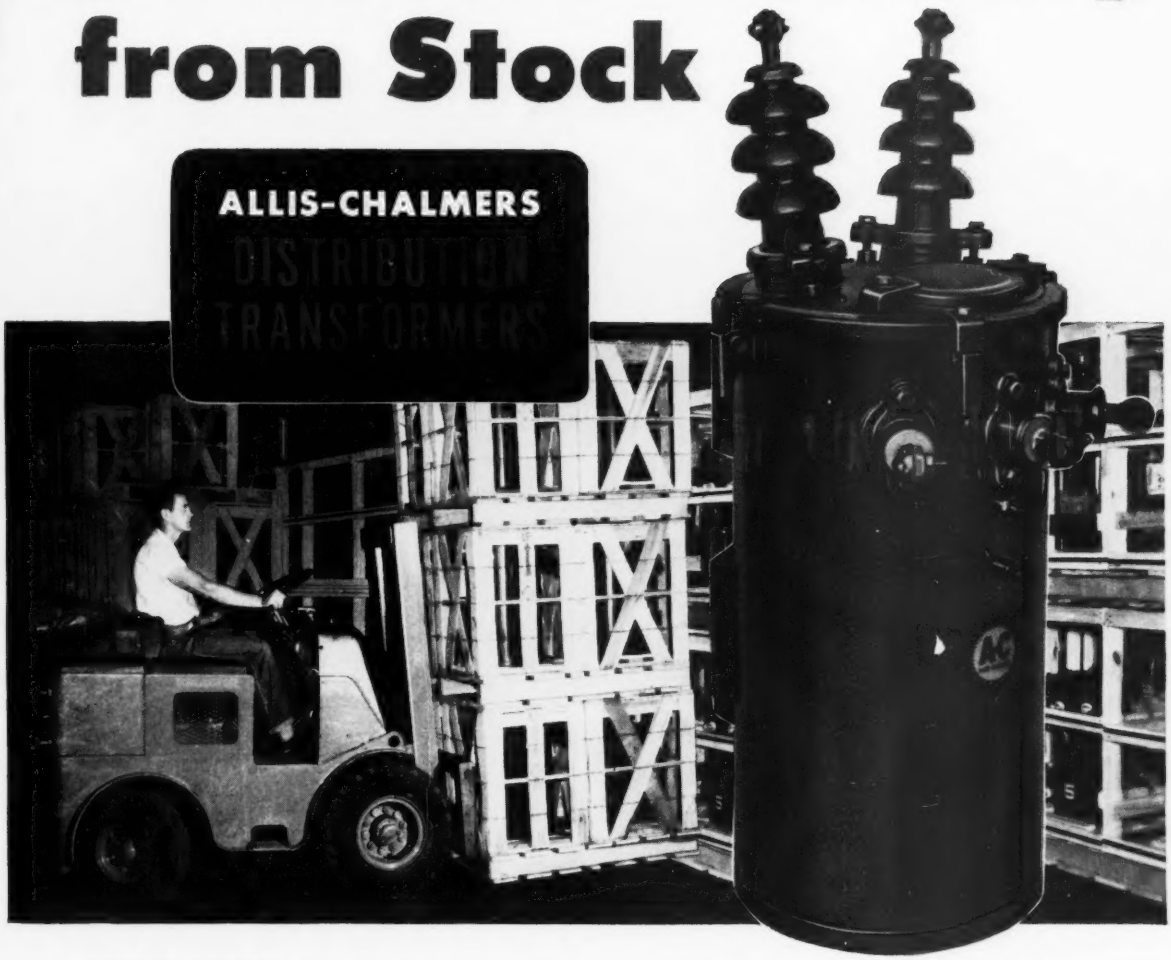

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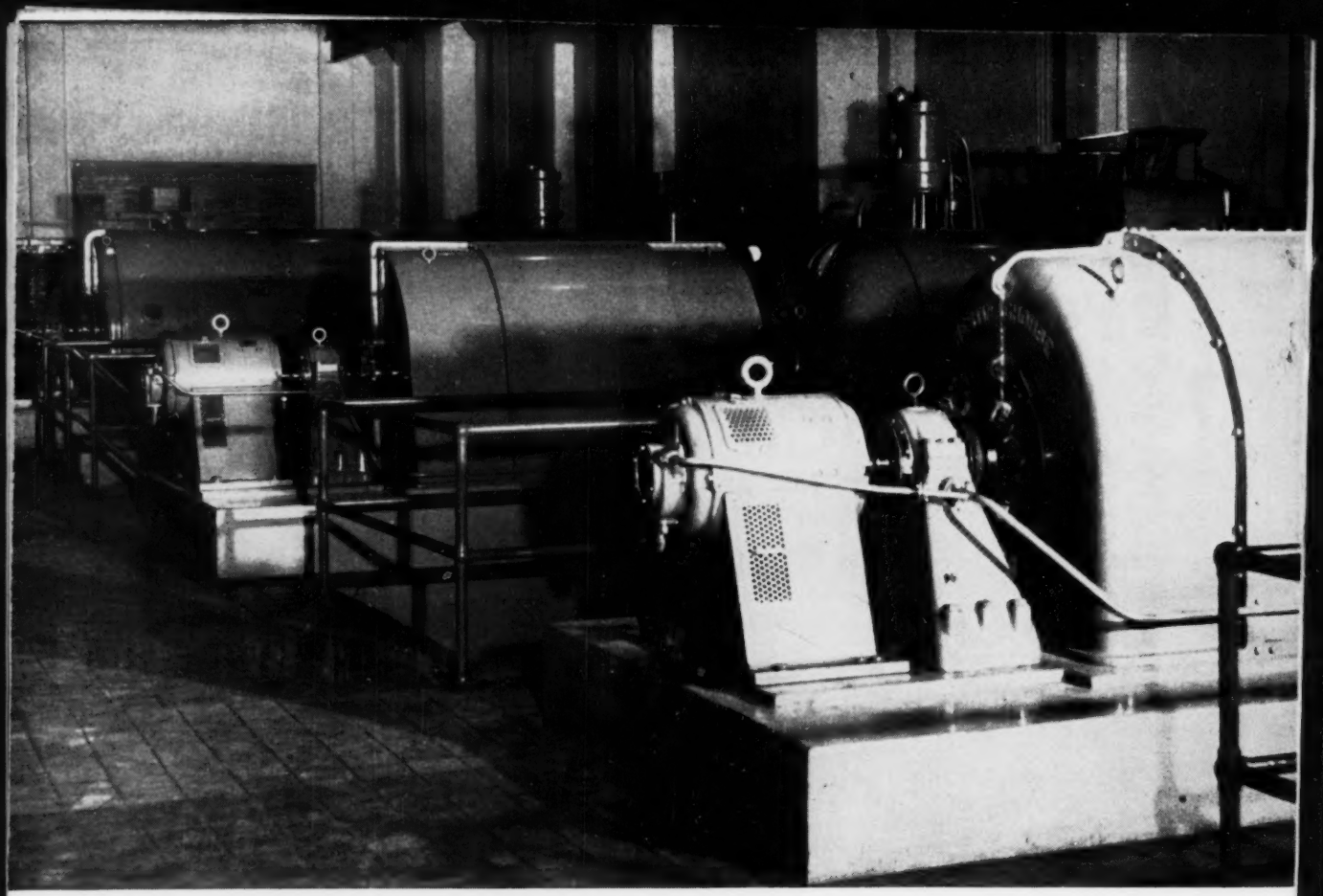

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